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ABSTRACT

Female representation in higher education increased significantly at several levels over the past decade. In this paper the trends are analyzed, and the potential role of policy changes that alter female representation is explored. The measure used in the analysis is the proportion of a given group that is female or the ratio of the number of women in the group to the total number of group members. Female representation in degree acquisitions over the period 1968 to 1978 is examined. Following the introduction and summary are separate sections on bachelor's degree recipients, master's degree recipients, doctoral degree recipients, professional degrees, and female representation on academic faculties (1972 to 1979) by rank, tenure status, and institution type. The appendix contains mathematical derivations for shift/share analysis. Tables provide numerous statistical data on female representation in degree programs and on faculties. Several reasons are suggested for the increased female representation in higher education: young women expect to spend more time in the labor force and therefore invest more in schooling; there has been an increase in the enforcement of antidiscrimination and affirmative action laws; and rewards have increased for highly educated women. (LC)

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FEMALE REPRESENTATION IN HIGHER EDUCATION: RETROSPECT AND PROSPECT

by

Adair L. Waldenberg

May 15, 1981

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CONTENTS

SECTION	page
1. INTRODUCTION AND SUMMARY	2
2. BACHELOR DEGREE RECIPIENTS, 1968 TO 1978	8
3. MASTER'S DEGREE RECIPIENTS, 1968 TO 1978	20
4. DOCTORAL DEGREE RECIPIENTS	28
5. PROFESSIONAL DEGREES, 1968 TO 1978	53
6. FEMALE REPRESENTATION ON ACADEMIC FACULTIES, 1972 TO 1979	62

Appendix	page
A. MATHEMATICAL DERIVATIONS FOR SHIFT/SHARE ANALYSIS	74

LIST OF TABLES

Table		page
1.	Number and Percentage Distribution of Bachelor's Degrees Awarded to Women, 1968 to 1978	11
2.	Female Representation Among Bachelor Degree Recipients by Field	13
3.	Decomposition of the Changes in Female Representation by Field by Causal Factor Among Bachelor's Degree Recipients	14
4.	Number and Percentage Distribution of Bachelor's Degrees Awarded to Men, 1968 to 1978	15
5.	Female Representation Among Master's Degree Recipients by Field	23
6.	Decomposition of the Changes in Female Representation by Causal Factor Among Master's Degree Recipients	24
7.	Number and Percentage Distribution of Master's Degrees Awarded to Women, 1968 to 1978	26
8.	Number and Percentage Distribution of Master's Degrees Awarded to Men, 1968 to 1978	27
9.	Female Representation Among Doctoral Degree Recipients, 1968 to 1978	30
10.	Decomposition of the Changes in Female Representation by Field by Causal Factor Among PhD Recipients	31
11.	Number and Percentage Distribution of Doctorates Awarded to Women, 1968 to 1978	33
12.	Number and Percentage Distribution of Doctorates Awarded to Men, 1968 to 1978	34
13.	Number of Doctoral Recipients and Women's Proportional Representation, by Field of Study, 1920 to 1979	37
14.	Female Representation Among PhD Recipients by Field and Type of Institution Granting PhD for Selected Years	43
15.	Distribution of Women PhD Recipients Across Fields and Type of PhD-Granting Institutions Attended, 1971 to 1978	44

16. Distribution of Male PhD Recipients Across Fields and Type of PhD-Granting Institution Attended, 1971 to 1978 46

17. Planned Postdoctoral Activity of Doctoral Degree Recipients, 1968 to 1979 48

18. Female Representation Among Professional Degree Recipients, 1968 to 1978 54

19. Number and Percentage Distribution of Professional Degrees Awarded to Men, 1968 to 1978 56

20. Number and Percentage Distribution of Professional Degrees Awarded to Women, 1968 to 1978 57

21. Decomposition of the Changes in Female Representation by Profession by Causal Factor among Professional Degrees Awarded 59

22. Total Number of Faculty Members and Proprotion of Faculty Who Are Women by Rank, Tenure Status and Institution Type 68

Tables 1 through 12, 14, 15, 16 and 18 through 22 were derived from the HEGIS Earned Degree and Salary/Employment files provided by the National Center for Education Statistics.

The data underlying tables 13 and 17 were derived from unpublished data derived from the Doctoral Records File provided by the Commission on Human Resources and the following publications of the Commission: Doctorate Production in the United States Universities 1920-1962, Doctorate Recipients from United States Universities 1958-1966, and Summary Report (1968, 1969,,1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979), Doctorate Recipients from United States Universities.

SECTION 1

INTRODUCTION AND SUMMARY

Female representation in higher education increased significantly at several levels over the past decade. A rising proportion of bachelor's, master's, doctoral, and professional degrees were granted to women, and the proportion of U.S. faculty members who are women also increased. In this paper these trends are analyzed and the potential role of policy changes that alter female representation is explored. Wherever possible trends are disaggregated and the lack of uniformity of improvements in female representation across faculty ranks, fields, etc. is highlighted.

In general there has been a surge in female participation in advanced and professional degree programs, as well as an increase in the number of women at junior faculty levels. In some cases, where the enrollment of men was growing at a slow rate or declining, the gains in female representation were significant. For purposes of this analysis we have selected one measure of female representation. It is defined as the proportion of a given group that is female, or the ratio of the number of women in the group to the total number of group members. For most purposes, the fifty percent level is used as a benchmark for representation. This equal representation benchmark is somewhat arbitrary, and it may not be a practical goal for all levels of higher education to attain.

Female representation in degree acquisitions is examined over the period 1968 to 1978. During the course of the analysis, it became evident that the midpoint of this period, 1973, was a natural watershed separating two periods which are quite different in character. Female representation progressed steadily and slowly during the first period, while during the second period rapid progress was made. Frequently the midpoint of this period marked the beginning of a decline in the degree acquisition by men. Because women continued to attain degrees at all levels in ever increasing numbers, the decline in degree acquisition by men contributed significantly to raising female representation in several fields.

The trends of degree acquisition by men probably reflect the declining returns to collegiate training, especially at the bachelor's degree and PhD levels, as well as the the end of the draft and the war in Vietnam. For women the war and the draft had minimal impacts on schooling attainment, except insofar as schooling levels rose due to delayed marriage and fertility while potential and actual spouses were away. The most important factor sustaining these degree acquisition trends for women is the return to schooling received in the labor market.

The increased pecuniary returns to college for women, compared to men, are the consequence of related endogenous and exogenous factors. The exogenous factors include (1) growth of the traditionally female service sector providing more jobs, (2)increase in the enforcement antidiscrimination and affirmative action laws, and (3) either a change in the "taste" for discrimination[1] or a decline in statistical discrimina-

[1] See Becker's The Economics of Discrimination, for details of the model.

tion due to increase in the numbers of women working[2] and the growth of the number of women at higher paying supervisory and faculty positions. Law enforcement as reflected in the enactment of the Equal Opportunity Act, the Labor Department's Revised Order #4, and other federal and state regulations undoubtedly played a significant role both directly and indirectly. As the job opportunities and rewards increased for highly educated women in the labor market, the expected rewards to, and thus the levels of investment in education of women increased.[3]

These higher expected returns in the labor market are, in part, responsible for increases in labor market commitments by women. As the opportunity cost of being out of the labor market rises, women at the margin will move back into the labor force. Younger generations of women making school choices will want to and plan to be in the labor force for more time than older generations of women. Thus the expected payback period for schooling investments and the cumulative returns both increase. This induces young women to invest in more schooling than older cohorts of women who did not expect to devote as much time to the labor force.[4]

At some levels, the increased supply of highly educated women is a disequilibrium phenomenon which will be followed by saturated labor markets, lower returns, and consequent reduced levels of educational in-

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[2] Possibly due to the enforcement of affirmative action regulations, more women worked and employers had better information on the value of women employees

[3] Undoubtedly affirmative action for women and minorities resulted in a decline in expected earnings for majority males.

[4] It also may be reflected in lower fertility rates as women want to spend more time in the labor force and less time at home raising children.

vestments in the future. While some women may adapt by returning to more traditional roles in the home, others will work for lower than expected wages paid for jobs which underutilize their training. Both for these women, and for society which probably subsidized their training, the rate of return on schooling investments will be low or negative. This may cause future cohorts of women to underinvest in their training because of expected low rates of return, and female representation might fall.

The evidence that we present here indicates that women are market responsive both in their choice of levels of training and field. To the degree to which affirmative action regulations have increased the opportunities open to women and the wages that women earn, these regulations undoubtedly have had a positive impact on female representation. Female representation at the bachelor's degree and master's degree levels have reached adequate levels (forty-seven percent and forty-eight percent respectively), although these levels are not uniform across fields. At the doctoral and professional degree levels at which women were traditionally underrepresented, progress has been significant, but representation is still well below thirty percent overall. One explanation is that in order for these investments to be equally profitable for equally qualified men and women, the labor force participation patterns for these men and women must be the same. Because women often spend more time out of the labor force than their male counterparts, the rewards to educational investments of these women are lower.

One of the primary recommendations of this paper is not to develop programs to encourage degree acquisitions by women through subsidies,

etc., but instead, to focus on the returns to educational investments. Given a desire to increase female representation, policies which inform individuals about expected labor market returns, and which also encourage more continuous labor force participation by women should be developed. Unlike the cost to society of subsidies which should be measured just against the benefits to society of increasing female representation, programs which encourage labor force participation have both the benefits of increasing female representation and of increasing the market output of society. These policies will raise the rewards to education for individual women as well as to society. If women who already have PhD's are encouraged to spend more time in the labor force, then the returns to the investment that they and society have made already will increase. A specific recommendation at the faculty hiring level is to encourage colleges and universities to hire part-time senior faculty whose appointments can be converted to full-time ones. Although out of the education policymakers' direct control, another policy is to encourage the provision of day care facilities.

Throughout the analysis, the role of educational subsidies is discussed. In most cases, this type of interference will exacerbate the disequilibria. Subsidies shift costs from private individuals to society, but unless women have less access to capital markets, there is no reason to believe that society should undertake the subsidization unless (a) the costs of the subsidies are less than the benefits (often unmeasurable) of increased female representation, and (b) that there are no other less costly, more productive ways to increase female representation (e.g., encouraging more continuous labor force participation of women).

Other policy recommendations are specific to each level of degree (and field) and to faculty representation. The changes in representation across fields are analyzed using a shift/share analysis. This enables us to attribute within-field changes in female representation to three causes (the change in the distribution of women across fields, the change in the distribution of men across fields, and the change in the proportion of degrees awarded across all fields that are awarded to women) and their interactions. Appendix A provides the mathematical derivation of these effects.

The analysis which follows has five sections. Sections two, three, four and five, which follow this one, examine female representation in degree acquisitions at the bachelor's, master's, doctoral, and professional levels respectively. The last section (six) examines female representation at the faculty level by rank, tenure status, and institution type.

SECTION 2

BACHELOR DEGREE RECIPIENTS, 1968 TO 1978

The postwar baby boom and the returns to schooling for the highly educated resulted in increased collegiate enrollment and degree acquisition throughout the 1960s, and a leveling off of enrollment and bachelor degrees awarded in the 1970s. During this same period, female representation increased substantially. By 1978 the proportion of bachelor degree recipients who are female was over forty-seven percent. This reflects a four percentage point increase over the period 1968 to 1978. While this is not as large as the increase in female representation at higher degree levels at which women were significantly underrepresented in the 1960s, this is still substantial. More importantly, it resulted in an increase in the supply of highly educated women to the labor market and to graduate schools. Over 160,000 more women received bachelor's degrees in 1978 than in 1968.

The number of bachelor's degree recipients who are women increased throughout the past decade, while the number of bachelor's degree recipients who are men peaked in 1973. The trends for men correspond to the timing of the end of the war in Vietnam and to the changes in returns to collegiate training. The war and the draft did not adversely affect the educational investments of women. In fact, schooling attainments may have risen due to delayed marriage and fertility while men were away.

Probably the most important factor motivating women to participate in increasing numbers in higher education was the reward to schooling that they expect to earn in the labor market. The job opportunities and wages offered to college educated women have increased substantially. The increases in the pecuniary returns to collegiate degrees have resulted from (1) growth of the service sector in which women are likely to be employed, (2) increased enforcement of affirmative action requirements includuing the Equal Opportunity Act, (3) a general decrease in discrimination not only directly as a result of the second factor, but also due to increased information about the profitability of hiring women as employers are exposed to more female employees,[5] and (4) as a result of these other changes, increased labor force commitments by women which lengthen the payback period and thus increase the returns to schooling. The latter endogenous change is a response to rising opportunity costs. As the cost of being out of the labor market (in the form of foregone earnings) rises, more women will enter and reenter the labor market and work more. Younger cohorts of women will plan to be in the labor force for more time, and thus will increase educational investments whose returns will be received over a longer period.

The increase in the supply of women with bachelor's degrees that has taken place over the past decade is a disequilibrium phenomenon similar to the one that we observe for highly educated labor in general in the 1970s. At some point, depending on technological change and other factors, we expect that the market for highly educated women will become saturated. Due to lags in the adjustment process, there will be a peri-

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[5] Specifically, statistical discrimination may have declined as employers gained more experience with female employees.

od of excess supply of highly educated women resulting in unemployment and reduced wages for this group and thus lower returns to higher education. While women may adapt to this situation by dropping out of the labor force and taking up more traditional roles in the home, many women will take jobs which underutilize their training. For women at the margin, the investment in higher education may actually have a negative rate of return when direct and indirect costs are taken into account. To the degree to which society subsidized the overinvestment of these women, the social rate of return may also be negative, depending on how one calculates the benefits of higher education.[6]

The oversupply of highly educated women will not be uniformly distributed across fields. The distribution of women receiving bachelor's degrees over the past decade has changed dramatically, resulting in significant changes in female representation across fields (see Table 1). For example, in business, over twenty-seven percent of those receiving bachelor degrees in 1978 were women compared to less than eleven percent in 1972. A detailed examination of changes in female representation over the past decade reveals several important patterns and provides a useful basis for predicting future trends.

In 1968, almost forty-three percent of bachelor's degree recipients were women, but this percentage varied from less than one percent for engineering degrees to seventy-eight percent for degrees in health professions. By 1978, the percent of degrees awarded to females varied from over six and one-half percent to seventy-two percent. The only two fields experiencing a decline in female representation over this period

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[6] If society receives substantial utility by providing education for education's sake, then the return may be positive.

Table 1

NUMBER AND PERCENTAGE DISTRIBUTION OF BACHELOR'S DEGREES AWARDED TO WOMEN, 1968 TO 1978

Field	1968	1969	1971	1973	1975	1977	1978
Biology	9,647 (3.5%)	10,833 (3.4%)	11,453 (3.1%)	14,255 (3.5%)	20,365 (4.8%)	25,114 (5.9%)	26,459 (6.0%)
Physical Science	11,959 (4.3%)	13,775 (4.3%)	13,193 (3.6%)	13,438 (3.3%)	12,984 (3.1%)	12,654 (2.9%)	12,769 (2.9%)
Engineering	212 (0.1%)	313 (0.1%)	408 (0.1%)	632 (0.2%)	1,052 (0.2%)	2,285 (0.5%)	3,752 (0.9%)
Social Science	55,334 (20.0%)	66,558 (20.8%)	80,035 (21.8%)	89,330 (21.9%)	92,326 (21.8%)	91,362 (21.3%)	92,729 (21.1%)
Humanities	62,236 (22.5%)	72,062 (22.5%)	81,745 (22.2%)	83,567 (20.4%)	81,256 (19.2%)	75,111 (17.5%)	73,851 (16.8%)
Business	7,318 (2.6%)	8,696 (2.7%)	10,803 (2.9%)	13,840 (3.4%)	22,223 (5.3%)	36,252 (8.4%)	44,604 (10.2%)
Health Professional	13,808 (5.0%)	15,704 (4.9%)	19,680 (5.4%)	26,131 (6.4%)	38,476 (9.1%)	45,811 (10.7%)	48,357 (11.0%)
Miscellaneous Prof.	13,461 (4.9%)	16,037 (5.0%)	18,134 (4.9%)	23,700 (5.8%)	30,854 (7.3%)	35,530 (8.3%)	36,772 (8.4%)
Education	103,141 (37.2%)	116,686 (36.4%)	132,236 (36.0%)	143,816 (35.2%)	123,703 (29.2%)	104,988 (24.5%)	99,842 (22.7%)
Total	277,116 (100%)	320,664 (100%)	367,687 (100%)	408,709 (100%)	423,239 (100%)	429,107 (100%)	439,135 (100%)

are humanities and education in which women traditionally have been overrepresented.

Table 2 summarizes the changes in female representation for the nine fields in which degrees are awarded.[7] As one can observe, the most dramatic changes are in "traditionally male" fields. Especially large increases occurred in biological science, business, and engineering in the 1973 to 1978 period.

Using the shift/share analysis described in the previous section, the changes in female representation across fields can be decomposed by causal factor (the results are described in Table 3).
At the bachelor's degree level, shifts in the distribution of men and women across fields, and not the increase in the number of women relative to the number of men receiving degrees, are responsible for the changes in representation within fields from 1968 to 1973. The change in the distribution of women across fields is the primary cause of changes in female representation in engineering, social science, humanities, and business. In physical science and the professions, both changes in the distribution of women and changes in the distribution of men across fields are significant, although offsetting, factors altering female representation in these fields from 1968 to 1973(see Table 4). These offsetting changes are due to the shrinking of the physical sciences and growth of the miscellaneous and health professions.[8]

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[7] These "fields" correspond roughly to HEGIS aggregations of subfields Detailed description of the aggregation methodology are availabe upon request from the author.

[8] If a field shrinks (i.e., both the number of men and number of women falls), then the departure of women has a negative effect and the departure of men has a positive effect on female representation. The reverse occurs if a field grows.

TABLE 2

Female Representation Among Bacheclor Degree Recipients by Field

Field	Percent Female 1968	Percent Female 1973	Percent Femal 1978
Biology	23.1	24.2	34.4
Physical Science	26.6	26.9	28.3
Engineering	.5	1.2	6.6
Social Science	37.4	39.7	46.6
Humanities	62.2	59.6	59.5
Business	9.0	10.8	27.3
Health Professions	78.1	77.0	80.6
Miscellaneous Professions	49.4	51.5	54.2
Education	75.9	73.5	72.5
Total	43.5	43.9	47.2

The picture for the 1973 to 1978 period is similar, but the increasing number of women relative to men plays a key role in changing female representation in certain fields. The change in the distribution of women receiving bachelor's degrees across fields has the most substantial positive impact on female representation in biological science,

Table 3. DECOMPOSITION OF THE CHANGES IN FEMALE REPRESENTATION BY FIELD AMONG BACHELOR'S DEGREE RECIPIENTS BY CAUSAL FACTOR

	TOTAL CHANGE IN THE PERCENT OF DEGREE RECIPIENTS WHO ARE WOMEN	PART OF TOTAL CHANGE DUE DIRECTLY FROM ONLY ΔP[1]	PART OF TOTAL CHANGE DUE DIRECTLY FROM ONLY ΔQm[2]	PART OF TOTAL CHANGE DUE DIRECTLY FROM ONLY ΔQf[3]	PART OF TOTAL CHANGE DUE TO THE INTERACTION OF ΔP AND ΔQm	PART OF TOTAL CHANGE DUE TO THE INTERACTION OF ΔP AND ΔQf	PART OF TOTAL CHANGE DUE TO THE INTERACTION OF ΔQm AND ΔQf	PART OF TOTAL CHANGE DUE TO THE INTERACTION OF ALL THREE FACTORS ΔP, ΔQm, ΔQf
1968-1978								
BIOLOGY	1.09	0.31	0.74	0.03	0.00	0.00	0.00	0.00
PHYSICAL SCIENCE	0.39	0.34	5.68	- 4.96	0.04	- 0.04	- 0.68	0.00
ENGINEERING	0.68	0.01	0.05	0.54	0.00	0.01	0.06	0.00
SOCIAL SCIENCE	2.30	0.40	- 0.25	2.14	0.00	0.01	- 0.01	0.00
HUMANITIES	- 2.61	0.40	- 0.78	- 2.23	0.00	0.01	- 0.02	0.00
BUSINESS	1.81	0.14	- 0.49	2.25	0.01	0.03	- 0.11	0.00
HEALTH PROFESSIONS	- 1.05	0.29	- 6.11	3.97	0.05	- 0.04	0.78	0.00
MISCELLANEOUS PROFESSIONS	2.10	0.43	- 2.75	4.42	0.00	0.00	0.00	0.00
EDUCATION	- 2.41	0.31	- 1.66	- 1.04	0.01	0.01	- 0.05	0.00
1973-78 19								20
BIOLOGY	10.25	2.50	- 3.14	11.35	- 0.23	0.58	- 0.86	0.06
PHYSICAL SCIENCE	1.36	2.67	1.17	- 2.34	0.07	- 0.15	- 0.07	0.00
ENGINEERING	5.42	0.17	- 0.10	5.14	- 0.01	0.66	- 0.39	- 0.05
SOCIAL SCIENCE	6.98	3.20	4.56	- 0.82	0.08	- 0.02	- 0.03	0.01
HUMANITIES	- 0.05	3.13	1.47	- 4.78	- 0.05	0.11	0.05	0.02
BUSINESS	16.53	1.34	- 0.90	15.83	- 0.10	1.32	- 0.95	- 0.02
HEALTH PROFESSIONS	3.54	2.25	- 9.19	8.22	0.56	- 0.67	2.36	0.01
MISCELLANEOUS PROFESSIONS	2.75	3.28	- 9.65	9.03	- 0.04	- 0.18	0.09	0.23
EDUCATION	- 1.03	2.49	4.62	- 9.31	- 0.32	0.48	0.96	0.05

[1] ΔP - Change in the percent of all bachelor degree recipients who are women.
[2] ΔQm - Change in the distribution across fields of male degree recipients.
[3] ΔQf - Change in the distribution across fields of female degree recipients.

Table 4

NUMBER AND PERCENTAGE DISTRIBUTION OF BACHELOR'S DEGREES AWARDED TO MEN, 1968 TO 1978

Field	1968	1969	1971	1973	1975	1977	1978
Biology	32,101 (8.9%)	36,227 (8.8%)	39,169 (8.2%)	44,666 (8.6%)	51,335 (10.1%)	52,572 (10.5%)	50,349 (10.3%)
Physical Science	33,079 (9.2%)	37,732 (9.2%)	37,680 (7.9%)	36,445 (7.0%)	33,349 (6.6%)	32,811 (6.6%)	32,358 (6.6%)
Engineering	39,431 (11.0%)	43,135 (10.5%)	50,484 (10.6%)	51,483 (9.9%)	46,900 (9.2%)	48,636 (9.7%)	52,832 (10.8%)
Social Science	92,738 (25.8%)	108,393 (26.3%)	125,183 (26.2%)	135,863 (26.1%)	126,229 (24.8%)	113,306 (22.7%)	106,060 (21.6%)
Humanities	37,832 (10.5%)	43,111 (10.5%)	52,297 (10.9%)	56,691 (10.9%)	54,380 (10.7%)	51,073 (10.2%)	50,200 (10.2%)
Business	74,186 (20.6%)	86,893 (21.1%)	105,906 (22.1%)	114,404 (21.9%)	113,232 (22.3%)	117,510 (23.5%)	118,670 (24.2%)
Health Professional	3,880 (1.1%)	4,436 (1.1%)	5,804 (1.2%)	7,801 (1.5%)	11,000 (2.2%)	12,034 (2.4%)	11,674 (2.4%)
Miscellaneous Prof.	13,793 (3.8%)	15,469 (3.8%)	16,498 (3.4%)	22,327 (4.3%)	26,953 (5.3%)	30,769 (6.2%)	31,023 (6.3%)
Education	32,707 (9.1%)	36,562 (8.9%)	45,402 (9.5%)	51,824 (9.9%)	45,046 (8.9%)	40,410 (8.1%)	37,900 (7.7%)
Total	359,747 (100%)	411,958 (100%)	478,423 (100%)	521,504 (100%)	508,424 (100%)	499,121 (100%)	491,066 (100%)

engineering, and business. In the professions, education, and physical science, changes in both the distribution of men and the distribution of women across fields strongly influence changes in female representation. However, in physical science as well as in social science and humanities, the increase in the number of women obtaining bachelor's degrees is a strong positive influence on female representation. In the case of the humanities the positive impact of the rising number of female recipients is more than offset by the distributional shift of women away from this field. Thus, the net change in female representation in the humanities from 1973 to 1978 is negative.

While we have provided explanations for the increasing participation of women in college degree programs, we have not yet explained the distributional shifts that we observe. With the exception of the humanities, engineering, and biological science education in the earlier period, the changes in the distribution of men and women in both periods follow similar patterns. In general, the fields in which women are traditionally overrepresented decline; fields in which women are underrepresented grow.[9] In growing fields like business, biology and engineering, women have switched to these fields much faster than men. In the declining fields of humanities and education the effect of the departure of women from these fields has more than offset the effect of the departure of men. Women have responded to the declining monetary rewards in the humanities, education, and elsewhere by shifting to more renumerative fields such as engineering and business. Women have been at least as market responsive as their male counterparts.

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[9] An important exception is the physical sciences. Six thousand fewer individuals received bachelor's degrees in 1978 than in 1968.

If there is one factor responsible for the changes in female representation at the bachelor's degree level across fields, it is the labor market. Programs to increase the participation of women may have had a small impact. To the degree to which affirmative action requirements open more opportunities for women in fields in which they are underrepresented, they may have a significant positive impact. Alternatively, the suppression of supply in these traditionally male field, (which may have resulted from either discrimination or voluntary career choices of women away from these fields reflecting women's tastes), may have caused higher wages and rewards to be paid to individuals with degrees in these fields in the past. These higher wages then may have induced the supply response that we observe. The phenomena that we observe in the 1970s in these fields (the growth of traditionally male fields and the concomitant rise in female representation in these areas) undoubtedly reflect the shift of individuals in response to a market disequilebrium. Once again, we expect these markets to become saturated and that rewards will decline in these fields. The length of time before the saturation point is reached will depend on the magnitude of the shortages in supply and the responsiveness of individuals to market rewards.

The prognosis for fields such as engineering is much better than the prognosis for humanities and education which have already been saturated. It is reassuring to note that women have adapted to change. While thirty-five percent of women bachelor's degree recipients majored in education in 1973, less than twenty three percent received B.A. degrees in education just five years later. In engineering, the only field in which women are still seriously underrepresented, the changes

have favored increases in female representation. The rewards in engineering are expected to persist over the next several years so gains in female representation in this field should be sustained and probably augmented.

The policy implications of the analysis of female representation at the bachelor's degree level are straightforward. Female representation overall is fairly high and growing. Underrepresentation in certain fields is being ameliorated currently by market forces. The supply of women with college degrees appears to be adequate to meet the needs of the labor market, and it is sizable enough to insure that there will be qualified women to enter graduate schools.[10] Any government policy to encourage female participation is likely to exacerbate the problems of the oversupply of highly educated women in the 1980s. In fact, if one were to recommend a specific policy at the bachelor's degree level, it would be a policy that makes information available to women high school students indicating the potentially temporary nature of the rewards to collegiate training. With the deemphasis of affirmative action by the Reagan administration, the decline in rewards may provide adequate feedback quickly.

In general, the best policy is one of letting the market find its own stable equilibrium. As noted earlier, it may be useful to reduce subsidies to education in areas where the oversupply of trained individuals results in low or negative social rates of return. Targeting money

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[10] Two qualifications are relevant here. First, in engineering this adequacy of supply is questionable at present, but this is a temporary phenomenon. Second, the actual supply a women for graduate schools will depend on the costs and rewards to further training. This issue will be examined in greater detail in the sections which follow.

to increase representation in fields other than engineering is totally unnecessary. Even in engineering, subsidies that alter investment strategies of individuals now are likely to result in overinvestment in the future. The market seems to favor increase in female representation. As the possibility and reality of overinvestment and lower returns becomes apparent, men and women will both adapt. Thus, little or no action is required by government at the bachelor's degree level.

SECTION 3

MASTER'S DEGREE RECIPIENTS, 1968 TO 1978

Compared to the increases in female representation at the bachelor's degree level, increases at the master's degree level have been more substantial and have occurred at a more uniform rate throughout the past decade. Less than thirty-six percent of master's degree recipients in 1968 were women. By 1973, over forty one percent of master's degree recipients were women, and by 1978 this percentage reached over forty-eight percent. Over the eleven year period women moved from underrepresentation to almost equal representation. As is the case at the bachelor's degree level, these changes undoubtedly reflect the responses of women to labor market incentives.

The supply of women with master's degrees increased dramatically over the period. More than twice as many women received master's degrees in 1978 compared to 1968. In comparison, the number of men receiving master's degrees rose seventy percent, corresponding to an increase of less than fifty thousand men receiving M.A. degrees over this same eleven year period. The number of master's degree recipients grew much more slowly during the late 1970s, and the total number of men receiving M.A. degrees declined between 1977 and 1978. This indicates that the number of master's degree recipients may decline in the 1980s. These trends primarily reflect two opposing phenomena. One is the declining rewards to master's degrees thus lowering the incentives to ob-

taining the degree, and the second is a decline in the rewards for bachelor's degrees (especially, for example, in education) which lowers the opportunity cost of graduate training and may increase the marginal payoff if the additional schooling significantly raises the probability of employment.[11] The latter effect probably is significant in areas such as education.

At the master's degree level, we expect to find the same endogenous and exogenous factors operate to increase female participation in higher education. Particularly in business, women have found more supervisory and management positions open to them. Frequently these positions require a master's degree for entry or promotion, and the investment in the additional schooling has a high payoff. As with the labor market for bachelor's degree recipients, the current labor market disequilibrium resulting from a rapid increase in demand for highly educated women (possibly resulting from affirmative action regulations) followed by a lagged supply adjustment, may evolve into a market saturated by overinvestors. The market, left to its own devices will equilibrate. Any policies that encourage investment beyond current levels will only cause increased levels of overinvestment and prolong the periods of disequilibrium. Because female representation at the master's degree level is almost fifty percent already, there is little objective support for government policies to promote increased female representation.

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[11] If Master's degrees are used as a screening device then individuals may obtain M.A. degrees to set themselves apart from those who only have bachelor's degrees. This is likely especially in "declining" fields.

Women constituted more than half of the 1978 master's degree recipients in the humanities, the professions, and education. In the sciences and business, women are still underrepresented, especially in engineering where only five percent of master's degrees were awarded to women in 1978. As one can see in Table 5, female representation has increased dramatically in most of these areas during the past decade. It will be difficult to increase female representation at the master's degree level in some of these areas (for example, engineering, biology) either because the opportunity cost of attending graduate school is too high or because more renumerative investments are open to these individuals (e.g., medical training). Because of the potential of market saturation, encouraging master's degree acquisitions by women is not a wise policy from a long run perspective.

The rising level of women participating in master's degree programs did increase representation in all fields from 1968 to 1970, and it had an especially strong positive impact on biology, physical science, social science, the humanities, the professions and education. Examining the decomposition of changes in female representation by field in table 6, one observes that the rising participation of women and the change in the distribution of women across fields are the two key factors underlying the changes in representation. Only in physical science (in both periods examined), health professions (in the first period), and education (in the second period) does the change in the distribution of men have any impact on within-field changes in female representation. In most fields where the changing distribution of women was an important factor, the effect was negative with two important exceptions.

TABLE 5

Female Representation Among Master's Degree Recipients by Field

Field	Percent Female 1968	Percent Female 1973	Percent Female 1978
Biology	22.4	23.6	29.3
Physical Science	17.5	19.3	22.2
Engineering	.7	1.7	5.1
Social Science	31.7	36.1	43.7
Humanities	49.7	52.5	55.2
Business	3.4	4.9	16.9
Health Professions	49.9	57.5	70.3
Miscellaneous Professions	53.0	55.8	58.2
Education	51.5	58.2	67.7
Total	35.8	41.4	48.3

In business and the health professions the impact was positive and large as women entered these fields at an unprecedented rate.

In both of these fields, female representation rose by twelve percentage points. This undoubtedly reflects the market opportunities in these fields rather than any change in government policy. In almost all

Table 6. DECOMPOSITION OF THE CHANGES IN FEMALE REPRESENTATION BY FIELD AMONG MASTER'S DEGREE RECIPIENTS BY CAUSAL FACTOR

	TOTAL CHANGE IN THE PERCENT OF DEGREE RECIPIENTS WHO ARE WOMEN	PART OF TOTAL CHANGE DUE DIRECTLY FROM ONLY ΔP[1]	PART OF TOTAL CHANGE DUE DIRECTLY FROM ONLY ΔQm[2]	PART OF TOTAL CHANGE DUE DIRECTLY FROM ONLY ΔQf[3]	PART OF TOTAL CHANGE DUE TO THE INTERACTION OF ΔP AND ΔQm	PART OF TOTAL CHANGE DUE TO THE INTERACTION OF ΔP AND ΔQf	PART OF TOTAL CHANGE DUE TO THE INTERACTION OF ΔQm AND ΔQf	PART OF TOTAL CHANGE DUE TO THE INTERACTION OF ALL THREE FACTORS ΔP, ΔQm, ΔQf
1968-1973								
BIOLOGY	1.28	4.39	2.73	- 5.01	0.33	- 0.72	- 0.46	0.01
PHYSICAL SCIENCE	1.85	3.69	3.28	- 4.22	0.48	- 0.72	- 0.64	- 0.02
ENGINEERING	1.07	0.17	0.15	0.45	0.04	0.12	0.11	0.03
SOCIAL SCIENCE	4.36	5.34	0.29	- 1.19	0.02	- 0.10	- 0.01	0.00
HUMANITIES	2.80	5.91	0.99	- 4.11	- 0.01	0.01	- 0.01	0.02
BUSINESS	1.50	0.87	- 0.65	1.42	- 0.16	0.34	- 0.26	- 0.06
HEALTH PROFESSIONS	7.62	5.91	- 8.35	10.05	- 0.06	- 0.36	0.05	0.39
MISCELLANEOUS PROFESSIONS	2.76	5.84	1.39	- 4.54	- 0.04	0.08	0.01	0.03
EDUCATION	6.69	5.88	- 1.22	2.04	0.02	- 0.05	0.00	0.01
1973-78								
BIOLOGY	5.64	5.41	- 0.95	1.19	- 0.14	0.16	- 0.03	0.00
PHYSICAL SCIENCE	2.91	4.73	3.13	- 4.15	0.50	- 0.77	- 0.52	0.00
ENGINEERING	3.43	0.54	0.08	2.05	0.02	0.61	0.09	0.03
SOCIAL SCIENCE	7.67	6.66	- 1.38	2.37	- 0.09	0.13	- 0.04	0.02
HUMANITIES	2.68	6.88	3.43	- 7.72	- 0.14	0.09	0.01	0.14
BUSINESS	11.98	1.48	- 1.10	11.79	- 0.32	2.77	- 2.28	- 0.37
HEALTH PROFESSIONS	12.83	6.65	- 3.22	9.64	0.16	- 0.80	0.28	0.13
MISCELLANEOUS PROFESSIONS	2.46	6.74	- 1.21	- 3.22	0.06	0.13	- 0.01	- 0.02
EDUCATION	9.55	6.61	4.37	- 1.25	- 0.32	0.07	0.04	0.02

[1] ΔP - Change in the percent of all bachelor degree recipients who are women.
[2] ΔQm - Change in the distribution across fields of male degree recipients.
[3] ΔQf - Change in the distribution across fields of female degree recipients.

fields in both time periods, the changing distribution of women has the opposite effect of the changing distribution of men (Tables 7 and 8 document these distributional shifts).[12]

The policy implications of the foregoing analysis are comparable to those states in the previous section on bachelor's degrees. Overall female representation is very close to fifty percent, and thus, on objective grounds there is no need to increase this level. Within specific fields, the market seems to provide adequate rewards to improve representation in seriously "traditionally" underrepresented fields such as business and engineering. One possible source of concern is the overrepresentation of women master's degree recipients in the health professions. If in this or other fields the market becomes saturated, rewards and consequently enrollments will decline.

Only in the sciences (including engineering) are there possible beneficial effects to be gained from policies to increase female representation. However, these gains should be weighed against the costs of (1) drawing qualified women out of the labor force in fields where they are earning high rewards (e.g., engineering), and (2) overtraining women so that later cohorts are discouraged by the low and possibly negative returns to the graduate training of their predecessors.

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[12] As pointed out earlier, if a field is shrinking (growing) uniformly, the change in the distribution of women has a negative (positive) impact, while the change in the distribution of men has a positive (negative) impact. Only in engineering are the impacts of both distributional changes positive. Women are increasingly entering engineering and men are decreasing their degree acquisition at the master's level in this field.

Table 7

NUMBER AND PERCENTAGE DISTRIBUTION OF MASTER'S DEGREES AWARDED TO WOMEN 1968 TO 1978

Field	1968	1969	1971	1973	1975	1977	1978
Biology	1,748 (2.8%)	1,890 (2.6%)	2,144 (2.3%)	2,201 (2.0%)	2.387 (1.8%)	3,007 (2.0%)	3,240 (2.1%)
Physical Science	2,112 (3.3%)	2,360 (3.3%)	2,601 (2.8%)	2,632 (2.4%)	2,664 (2.0%)	2,705 (1.8%)	2,711 (1.8%)
Engineering	99 (0.2%)	113 (0.2%)	187 (0.2%)	290 (0.3%)	400 (0.3%)	757 (0.5%)	897 (0.6%)
Social Science	7,621 (12.0%)	8,683 (12.0%)	10,537 (11.3%)	12,454 (11.4%)	15,256 (11.6%)	18,268 (12.2%)	19,013 (12.6%)
Humanities	9,812 (15.5%)	10,862 (15.0%)	14,380 (15.5%)	14,374 (13.1%)	15,292 (11.6%)	14,563 (9.7%)	14,548 (9.6%)
Business	618 (1.0%)	683 (0.9%)	1,045 (1.1%)	1,533 (1.4%)	3,080 (2.3%)	6,681 (4.5%)	8,216 (5.4%)
Health Professional	1,883 (3.0%)	2,085 (2.9%)	3,272 (3.5%)	4,888 (4.5%)	6,697 (5.1%)	8,889 (5.9%)	10,183 (6.7%)
Miscellaneous Prof.	6,735 (10 6%)	7,758 (10.7%)	8,710 (9.4%)	9,701 (8.9%)	11,027 (8.4%)	11,731 (7.8%)	11,752 (7.8%)
Education	32,773 (51.7%)	37,993 (52.5%)	50,020 (53.8%)	61,450 (56.1%)	74,733 (56.8%)	83,430 (55.6%)	80,548 (53.3%)
Total	63,401 (100%)	72,427 (100%)	92,896 (100%)	109,523 (100%)	131,536 (100%)	150,031 (100%)	151,108 (100%)

Table 8

NUMBER AND PERCENTAGE DISTRIBUTION OF MASTER'S DEGREES AWARDED TO MEN 1968 TO 1978

Field	1968	1969	1971	1973	1975	1977	1978
Biology	6,070 (5.3%)	6,425 (5.3%)	6,331 (4.6%)	7,111 (4.6%)	7,443 (4.6%)	8,032 (4.8%)	7,826 (4.8%)
Physical Science	9,974 (8.8%)	10,780 (8.9%)	10,837 (7.8%)	10,987 (7.1%)	9,980 (6.2%)	9,300 (5.5%)	9,483 (5.9%)
Engineering	15,089 (13.3%)	15,130 (12.4%)	16,296 (11.8%)	16,590 (10.7%)	15,255 (9.4%)	16,459 (9.8%)	16,523 (10.2%)
Social Science	16,421 (14.4%)	18,087 (14.9%)	18,994 (13.7%)	22,083 (14.2%)	24,673 (15.2%)	25,646 (15.2%)	24,469 (15.1%)
Humanities	9,936 (8.7%)	10,727 (8.8%)	12,512 (9.0%)	13,011 (8.4%)	13,235 (8.2%)	12,226 (7.3%)	11,824 (7.3%)
Business	17,503 (15.4%)	19,002 (15.6%)	25,609 (18.5%)	29,706 (19.2%)	33,370 (20.6%)	39,969 (23.8%)	40,445 (25.0%)
Health Professional	1,894 (1.7%)	2,034 (1.7%)	2,630 (1.9%)	3,616 (2.3%)	4,145 (2.6%)	4,203 (2.5%)	4,300 (2.7%)
Miscellaneous Prof.	5,971 (5.2%)	6,009 (4.9%)	6,334 (4.6%)	7,694 (5.0%)	8,514 (5.3%)	9,075 (5.4%)	8,429 (5.2%)
Education	30,891 (27.2%)	33,430 (27.5%)	39,047 (28.2%)	44,196 (28.5%)	45,500 (28.1%)	43,300 (25.7%)	38,409 (23.8%)
Total	113,749 (100%)	121,624 (100%)	138,590 (100%)	154,994 (100%)	162,115 (100%)	168,210 (100%)	161,708 (100%)

SECTION 4

DOCTORAL DEGREE RECIPIENTS

While women are underrepresented in PhD acquisition, the progress over the past decade has been substantial, especially from 1973 to 1978. In 1978, twenty-six percent of individuals receiving doctorates were women, compared to only twelve and one-half percent in 1968. Almost three times as many women received PhD degrees in 1978 than in 1968. In fact, more women received PhDs in 1978 than the total number of all individuals receiving PhD degrees in 1957! Furthermore, the number of women receiving doctorates has continued to rise, while the number of men receiving doctorates peaked in the early 1970s and has subsequently declined steadily.

These trends favor substantial inreases in female representation at the faculty level of the academic sector and in other sectors employing doctoral degree recipients.[13] Because the production of women PhDs is large relative to the total stock of doctoral recipients, the impact is obvious. Of course, because the increases in female PhD degree acquisitions have been relatively recent, the impact has been strongest at junior levels. The dramatic increase in high level degree acquisition by women, when men's participation in PhD level programs has been declining, is attributable to many of the same factors that explained trends in bachelor's and master's degrees.

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[13] The issue of female representation of faculties of U.S. colleges and universities will be explored in depth in a subsequent section.

The exogenous and endogenous factors relating to labor market returns are critical to the changing patterns. Affirmative action, including increasing emphasis on recruiting female faculty members for higher education, has increased the number of job opportunities open to women. The increased availability of management and supervisory position requiring graduate training resulted in rising levels of degree acquisition by women. In the most dramatic case, less than one half of one percent of women PhD recipients were getting degrees in business in 1968. By 1978, over ten percent of women receiving PhD degrees were setting degrees in business. Female representation in this field rose from three percent to eight percent over that same period. While the changes in the distribution of women across fields have a significant impact on within field changes in female representation for selected fields, especially in the 1968 to 1973 period, the overriding factor influencing female representation within fields has been the change in the number of women relative to the total number of PhD recipients.

Table 10 depicts the importance of the rising participation of women in a doctoral program in changing female representation especially in the latter period (1973 to 1978). Between 1968 and 1978, the increase in the proportion of doctoral recipients who are women was the major factor in six of nine fields, but in the subsequent period it was the overriding factor in all fields. The changing distribution of men was not an important influence on any field in either of the two periods, with the exception of miscellaneous professions between 1973 and 1978. In miscellaneous professions (1973 to 1978) female representation actually fell due to the rising participation of men in this area. The

TABLE 9

Female Representation Among Doctoral Degree Recipients, 1968 to 1978

Field	Percent Female 1968	Percent Female 1973	Percent Female 1978
Biology	13.1	15.8	20.1
Physical Science	5.2	7.4	11.1
Engineering	.4	1.8	2.3
Social Science	15.2	20.0	30.0
Humanities	22.6	31.7	40.6
Business	3.0	5.7	8.3
Health Professions	12.8	24.9	38.5
Miscellaneous Professions	15.2	19.4	18.2
Education	20.3	24.8	39.0
Total	12.5	17.9	26.4

change in the distribution of women only had a significant impact on engineering, business, and the health professions during the 1968 to 1973 period, and on humanities in the latter period in which this distributional effect was negative.

Table 10. DECOMPOSITION OF THE CHANGES IN FEMALE REPRESENTATION BY FIELD AMONG Ph.D. RECIPIENTS BY CAUSAL FACTOR

	TOTAL CHANGE IN THE PERCENT OF DEGREE RECIPIENTS WHO ARE WOMEN	PART OF TOTAL CHANGE DUE DIRECTLY FROM ONLY ΔP[1]	PART OF TOTAL CHANGE DUE DIRECTLY FROM ONLY ΔQm[2]	PART OF TOTAL CHANGE DUE DIRECTLY FROM ONLY ΔQf[3]	PART OF TOTAL CHANGE DUE TO THE INTERACTION OF ΔP AND ΔQm	PART OF TOTAL CHANGE DUE TO THE INTERACTION OF ΔP AND ΔQf	PART OF TOTAL CHANGE DUE TO THE INTERACTION OF ΔQm AND ΔQf	PART OF TOTAL CHANGE DUE TO THE INTERACTION OF ALL THREE FACTORS ΔP, ΔQm, ΔQf
1968-1973								
BIOLOGY	2.61	5.53	0.65	- 2.70	0.21	- 0.94	- 0.11	- 0.02
PHYSICAL SCIENCE	2.15	2.50	1.19	- 1.18	0.51	- 0.53	- 0.25	- 0.09
ENGINEERING	1.38	0.21	0.07	0.61	0.03	0.31	0.10	0.04
SOCIAL SCIENCE	4.79	6.19	- 0.77	- 0.31	- 0.24	- 0.09	0.01	0.00
HUMANITIES	9.05	8.11	- 1.86	2.79	- 0.42	0.56	- 0.16	0.02
BUSINESS	2.64	1.50	- 0,86	2.24	- 0.41	1.02	- 0.61	- 0.25
HEALTH PROFESSIONS	12.17	5.41	- 4.53	13.54	- 1.66	3.43	- 3.82	- 0.20
MISCELLANEOUS PROFESSIONS	4.25	6.17	0.34	- 1.77	0.10	- 0.56	- 0.03	0.00
EDUCATION	4.44	7.59	- 2.88	0.42	- 0.75	0.10	- 0.05	0.00
1973-78								
BIOLOGY	4.38	7.81	- 0.62	- 1.93	- 0.23	- 0.72	0.06	0.01
PHYSICAL SCIENCE	3.70	4.24	0.65	- 0.93	0.32	- 0.47	- 0.08	- 0.03
ENGINEERING	.54	1.13	0.38	- 0.61	0.23	- 0.38	- 0.13	- 0.08
SOCIAL SCIENCE	10.02	9.18	- 1.02	1.74	- 0.31	0.48	- 0.07	- 0.01
HUMANITIES	8.93	11.64	3.60	- 5.60	0.41	- 0.95	- 0.36	0.19
BUSINESS	2.62	3.35	- 0.45	- 0.03	- 0.24	- 0.01	0.00	0.00
HEALTH PROFESSIONS	13.61	10.45	- 0.01	2.64	0.00	0.54	0.00	0.00
MISCELLANEOUS PROFESSIONS	- 1.25	9.01	- 7.85	0.45	- 2.84	0.13	- 0.16	- 0.01
EDUCATION	14.18	10.42	- 0.30	3.45	- 0.07	0.69	- 0.03	0.01

[1] ΔP - Change in the percent of all bachelor's degree recipients who are women.
[2] ΔQm - Change in the distribution across fields of male degree recipients.
[3] ΔQf - Change in the distribution across fields of female degree recipients.

The distribution of doctoral recipeints who are women across fields (see Table 11) has not changed as dramatically nor in the same direction as the distribution of women at the bachelor's and master's degree levels. Except in engineering, the proportion of women receiving doctorates in the sciences has declined substantially since 1968, while the proportions of women receiving doctorates in the health, business, and miscellaneous professions and education have increased. Thus, women generally have tended to continue to obtain degrees in the more "traditionally" female fields. However, this does not necessarily imply that women receiving doctorates in the 1970s have not responded to labor market conditions.

In analyzing the distribution of women across fields at the doctoral level compared the bachelor's and master's degree level, several features of women doctoral students are important. First, many women receiving doctorates, especially in education, are older women who are already committed to a career.[14] In some fields the age composition has changed dramatically implying differing field choices by older women who are undoubtedly committed to a field by previous training, experience, or current employment and by younger women who may have more flexibility in their choices. For example, the median age doctoral recipients in the professions in 1974 was 36.1, compared to 34.1 in 1979.[15] The trend in median age of women doctoral recipients in the arts and humanities was the opposite, with the median age rising from 32.4 to 33.3 over the

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[14] The median age of women receiving PhDs in education was 37 in 1979.

[15] Summary Reports 1974 and 1979 published by the National Research Council.

Table 11

NUMBER AND PERCENTAGE DISTRIBUTION OF DOCTORATES
AWARDED TO WOMEN 1968 TO 1978

Field	1968	1969	1971	1973	1975	1977	1978
Biology	452 (15.5%)	483 (14.1%)	627 (13.7%)	741 (11.9%)	781 (10.7%)	794 (9.8%)	868 (10.2%)
Physical Science	240 (8.2%)	277 (8.1%)	342 (7.5%)	391 (6.3%)	429 (5.9%)	453 (5.6%)	462 (5.4%)
Engineering	12 (0.4%)	12 (0.4%)	23 (0.5%)	64 (1.0%)	67 (0.9%)	74 (0.9%)	57 (0.7%)
Social Science	630 (21.6%)	759 (22.2%)	981 (21.4%)	1,309 (21.1%)	1,715 (23.6%)	1,958 (24.2%)	1,986 (23.4%)
Humanities	585 (20,0%)	745 (21.8%)	1,034 (22.6%)	1,451 (23.3%)	1,512 (20.8%)	1,531 (18.9%)	1,508 (17.8%)
Business	14 (0.5%)	14 (0.4%)	23 (0.5%)	53 (0.9%)	41 (0.6%)	55 (0.7%)	72 (0.8%)
Health Professional	31 (1.1%)	36 (1.1%)	77 (1.7%)	161 (2.6%)	177 (2.4%)	172 (2.1%)	252 (3.0%)
Miscellaneous Prof.	126 (4.3%)	126 (3.7%)	117 (2.6%)	232 (3.7%)	249 (3.4%)	288 (3.6%)	326 (3.8%)
Education	830 (28.4%)	970 (28.3%)	1,355 (29.6%)	1,813 (29.2%)	2,296 (31.6%)	2,769 (34.2%)	2,956 (34.8%)
Total	2,920 (100%)	3,422 (100%)	4,579 (100%)	6,215 (100%)	7,267 (100%)	8,094 (100%)	8,487 (100%)

Table 12

NUMBER AND PERCENTAGE DISTRIBUTION OF DOCTORATES AWARDED TO MEN 1968 TO 1978

Field	1968	1969	1971	1973	1975	1977	1978
Biology	2,988 (14.7%)	3,281 (14.5%)	4,112 (14.9%)	3,963 (13.9%)	3,611 (13.5%)	3,524 (14.0%)	3,443 (14.5%)
Physical Science	4,341 (21.3%)	4,758 (21.0%)	5,383 (19.6%)	4,899 (17.1%)	4,406 (16.4%)	3,951 (15.7%)	3,705 (15.7%)
Engineering	2,920 (14.3%)	3,365 (14.8%)	3,632 (13.2%)	3,515 (12.3%)	3,086 (11.5%)	2,528 (10.1%)	2,388 (10.1%)
Social Science	3,513 (17.2%)	4,024 (17.7%)	4,649 (16.9%)	5,238 (18.3%)	5,255 (19.6%)	4,969 (19.8%)	4,630 (19.6%)
Humanities	2,002 (9.8%)	2,054 (9.1%)	2,974 (10.8%)	3,132 (11.0%)	2,727 (10.2%)	2,376 (9.4%)	2,207 (9.3%)
Business	446 (2.2%)	532 (2.3%)	787 (2.9%)	879 (3.1%)	970 (3.6%)	814 (3.2%)	795 (3.4%)
Health Professional	212 (1.0%)	247 (1.1%)	389 (1.4%)	485 (1.7%)	441 (1.6%)	366 (1.5%)	402 (1.7%)
Miscellaneous Prof.	705 (3.5%)	555 (2.4%)	565 (2.1%)	963 (3.4%)	1,176 (4.4%)	1,436 (5.7%)	1,469 (6.2%)
Education	3,249 (15.9%)	3,859 (17.0%)	5,043 (18.3%)	5,501 (19.3%)	5,147 (19.2%)	5,186 (20.6%)	4,630 (19.6%)
Total	20,376 (100%)	22,675 (100%)	27,534 (100%)	28,575 (100%)	26,819 (100%)	25,150 (100%)	23,669 (100%)

same period.[16]

Older women completing PhDs in the social sciences and arts and humanities may be responding to labor market opportunities which are now open to them due to affirmative action, reduced discrimination, and their rising levels of experience and labor force commitment.[17] In both these areas, the increase in the median age probably reflects the rising investments of older women already in traditional fields and the declining investments of younger women in these same fields.

This age phenomenon does not explain why the proportion of women doctoral recipients in education has risen when opportunities do not seem to have grown. In this case, a possible explanation, aside from commitments to education and opportunities for supervisory positions to doctoral degree holders, is the low opportunity cost these women face. Job opportunities for individuals with bachelor's and master's degrees in education are not very good. The converse opportunity cost situation exists in the sciences and may explain why the porportion of women in this area has not increased. In computer science and engineering, lucrative opportunities for women with B.A.s and M.A.s have raised the foregone earnings component of the cost of a PhD in these areas so high, that few additional women are induced to obtain PhDs. In the biological sciences, the high returns to medicine may lure potential female PhD

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16 Ibid

17 Older women also may be obtaining a doctorate partially as a consumption good. Because the payback period is shorter for these older women, the likelihood of their decisions resulting in a higher rate of monetary return is small. Undoubtedly, all women enroll in doctoral programs for both consumption and investment benefits, but the investment criterion probably is the overriding factor for most younger women.

students away from applying to doctoral programs. Thus, the opportunity cost explanation supports the hypothesis that women are market responsive and provides insight into why patterns of field choice differ across degree levels.

Another factor which must be taken into account, when comparing women doctoral recipients to lower level degree recipients, is the length of time it takes to complete a PhD. The median registered time between a B.A. and a PhD among 1979 doctoral recipients who are women was 6.4 years. Thus, the field choices of the rising number of women in doctoral programs in the mid 1970s would not be reflected in the data presented. The time lags in PhD acquisition are partly responsible for the smaller distributional changes across fields than those shifts we observed for bachelor's and master's degree recipients. We expect over time, to see more patterns of increase similar to those that we observe for business doctoral recipients who are women, and more similar to the patterns at other levels.

One advantage of examining female representation at the doctoral level is the availability of a longer historical record due to the existence of information from the National Research Council's Doctoral Records File. Table 13 provides an historical record of female representation by field from 1920 to 1979. Although space and time constraints do not permit a detailed analysis of these data, a few observations are made below.

First, we can see in this historical context, that the levels of overall female representation among doctoral recipients has reached unprecendented levels in the late 1970s. The earlier peak of women being

Table 12 NUMBER OF DOCTORATE RECIPIENTS AND WOMEN'S PROPORTIONAL REPRESENTATION, BY FIELD OF STUDY, 1920-79

Doctorate Recipients

DATE	Physical Sciences, Engineering, Math (PSEM)[1]		Life Sciences (LS)[2]		Social Sciences (SS)[3]		Arts and Humanities (AH)[4]		Professions (P)[5]		Education (E)[6]		Unspecified Fields (UNSP)[7]		Total (TOTAL)	
	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women
1920	154	10.3	133	18.7	89	15.7	118	22.8	18	0.0	48	16.6	--	--	560	16.0
1921	199	10.0	133	11.2	111	13.5	151	33.1	32	6.2	32	15.6	--	--	660	16.2
1922	247	6.4	159	16.3	102	23.5	181	21.5	32	3.1	59	11.8	--	--	780	14.4
1923	332	5.4	243	17.6	153	16.9	221	23.5	45	8.8	68	20.5	--	--	1062	14.7
1924	372	7.7	213	12.6	156	22.4	229	25.3	52	9.6	102	12.7	--	--	1124	17.4
1925	331	8.1	245	17.9	208	18.2	236	27.1	55	10.9	128	18.7	--	--	1203	16.8
1926	455	6.1	258	14.3	228	14.0	272	25.7	64	6.2	161	19.2	--	--	1438	13.6
1927	424	7.7	290	18.9	262	11.8	304	25.3	88	6.8	170	16.4	--	--	1538	14.9
1928	469	4.6	326	15.3	258	18.9	318	23.5	77	6.4	169	18.3	--	--	1617	14.3
1929	503	7.7	369	15.1	348	18.9	394	26.3	84	5.9	209	23.9	--	--	1907	20.1
1930	607	6.7	378	17.1	314	14.0	420	25.0	74	8.1	265	18.8	--	--	2058	15.1
1931	631	8.2	469	14.2	366	15.3	456	26.0	107	7.4	300	18.0	--	--	2329	15.2
1932	638	8.4	456	18.4	370	15.6	505	23.9	121	5.7	307	19.2	--	--	2397	15.9
1933	755	5.2	474	13.9	355	15.4	507	26.2	101	9.9	260	15.7	--	--	2452	14.0
1934	814	5.6	573	16.7	391	11.7	532	23.4	102	5.8	280	16.0	--	--	2692	13.0
1935	783	4.9	518	11.9	405	13.3	558	24.1	132	9.8	246	24.3	--	--	2582	14.0
1936	814	5.1	545	18.5	348	17.5	584	22.7	104	4.8	354	21.7	--	--	2749	15.2
1937	882	6.3	504	14.6	374	19.2	551	22.3	81	8.6	357	20.4	--	--	2749	14.7

Table 13 cont.

Doctorate Recipients

DATE	(PSEN)[1]		(LS)[2]		(SS)[3]		(AH)[4]		(P)[5]		(E)[6]		(UNSP)[7]		(TOTAL)	
	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women
1938	757	4.6	585	14.3	373	20.6	572	25.6	83	4.8	361	20.2	--	--	2731	15.3
1939	833	5.0	588	14.7	380	17.6	584	21.7	95	9.4	367	21.5	--	--	2847	14.4
1940	940	5.3	713	12.0	431	13.2	607	21.2	90	5.5	464	26.0	--	--	3245	12.9
1941	1117	3.0	716	9.8	472	13.7	678	20.6	106	4.7	477	20.3	--	--	3566	11.3
1942	978	3.8	727	10.1	436	14.2	610	19.8	145	7.5	490	22.8	--	--	3386	12.3
1943	772	4.5	560	9.6	295	18.6	435	31.2	105	5.7	397	26.1	--	--	2564	15.2
1944	655	4.4	380	18.6	221	19.0	263	32.3	104	10.5	316	28.4	--	--	1939	16.9
1945	463	5.8	309	21.0	186	21.5	271	33.5	107	12.1	293	33.1	--	--	1629	20.4
1946	584	7.7	316	21.5	292	19.1	367	26.7	79	21.5	350	27.4	--	--	1988	19.1
1947	866	5.3	528	15.3	438	14.6	555	21.9	115	7.8	447	19.9	--	--	2949	13.9
1948	1271	3.8	689	12.4	538	11.7	599	20.0	134	8.2	662	20.5	--	--	3893	11.9
1949	1976	3.1	942	9.4	768	11.3	704	17.0	170	10.0	836	19.8	--	--	5396	10.0
1950	2245	2.5	1111	10.1	981	9.8	935	17.8	215	8.3	1030	15.5	--	--	6517	9.4
1951	2471	2.9	1208	11.5	1200	10.8	1096	14.2	248	4.8	1109	16.3	--	--	7332	9.2
1952	2506	2.9	1357	8.6	1273	10.2	1024	14.5	245	10.2	1305	17.5	--	--	7710	9.4
1953	2491	2.8	1588	8.7	1410	9.6	1222	12.7	242	7.8	1416	18.4	--	--	8369	9.3
1954	2511	2.5	1652	8.4	1506	9.2	1283	14.2	258	6.2	1506	16.6	--	--	8716	9.1
1955	2589	2.8	1650	7.8	1615	11.2	1211	14.5	263	9.5	1571	17.8	--	--	8899	9.7
1956	2426	2.7	1500	7.8	1505	9.8	1132	15.9	276	7.2	1634	15.9	--	--	8473	9.3
1957	2535	3.2	1634	9.8	1485	13.5	1261	17.8	310	8.3	1375	21.8	--	--	8600	11.5
1958	2558	2.7	1585	9.7	1671	13.5	1209	16.0	323	12.0	1494	20.0	--	--	8840	11.1

Table 13 cont.

Doctorate Recipients

DATE	(PSEM)[1]		(LS)[2]		(SS)[3]		(AH)[4]		(P)[5]		(E)[6]		(UNSP)[7]		(TOTAL)	
	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women	Total Number	Percent Women
1959	2846	2.7	1627	9.4	1712	12.7	1314	15.5	329	9.4	1530	19.1	--	--	9358	10.4
1960	3044	2.5	1776	8.4	1723	13.8	1467	17.6	366	10.6	1624	20.1	--	--	10000	10.9
1961	3367	3.0	1802	10.2	1908	13.9	1542	15.4	388	11.5	1794	19.0	--	--	10801	10.9
1962	3701	2.8	1975	9.7	1890	12.7	1566	17.9	468	12.4	1893	19.0	7	--	11500	10.7
1963	4268	3.2	2083	9.9	2027	13.0	1669	17.3	534	15.2	2137	19.5	12	8.3	12730	10.9
1964	4779	3.1	2361	10.3	2258	13.8	1992	17.2	565	11.7	2351	19.1	19	10.5	14325	10.9
1965	5624	3.3	2684	10.4	2327	12.5	2336	17.3	629	11.8	2736	19.3	5	--	16341	10.8
1966	6129	3.1	2885	11.9	2619	14.4	2519	19.8	734	13.4	3040	19.0	23	--	17949	11.6
1967	6938	3.1	3144	13.3	3101	14.4	2872	19.5	842	12.0	3481	19.8	28	21.4	20406	12.0
1968	7460	3.2	3683	13.8	3468	15.7	3196	22.3	937	10.5	4015	19.8	79	5.0	22838	12.7
1969	8224	3.2	4127	13.7	3964	16.7	3566	23.4	1015	12.4	4649	19.4	189	10.5	25734	13.1
1970	9057	3.6	4576	12.8	4564	16.1	4067	23.8	1215	11.7	5860	20.2	160	6.2	29499	13.4
1971	9231	3.8	5070	14.1	5168	17.7	4376	24.2	1437	12.2	6431	20.9	143	14.6	31856	14.4
1972	8982	4.2	4984	14.6	5590	18.7	4701	27.0	1506	12.2	7079	23.2	159	10.7	33001	16.0
1973	8576	4.9	5068	17.1	5911	21.0	5364	28.8	1461	13.6	7248	24.6	99	16.2	33727	18.0
1974	8036	5.0	4894	17.6	6156	23.2	5174	30.3	1421	13.7	7261	26.7	58	15.5	33000	19.4
1975	7719	5.7	5022	19.0	6307	25.3	5046	33.4	1446	14.2	7349	31.1	24	33.3	32913	21.9
1976	7236	6.3	4971	19.4	6583	26.3	4883	34.3	1474	19.6	7727	32.8	49	26.5	32923	23.3
1977	7010	7.2	4767	20.0	6504	28.1	4559	36.3	1340	22.6	7448	34.6	44	22.7	31672	24.8
1978	6616	7.4	4887	22.1	6453	30.2	4235	37.7	1454	22.6	7190	39.6	15	46.7	30850	26.9
1979	6792	8.2	5076	23.4	6379	33.0	4143	38.5	1414	25.7	7370	42.1	26	38.5	31200	28.6

[1] Physical Science, Engineering, and Mathematics
[2] Life Science
[3] Social Science
[4] Arts and Humanities
[5] Professions
[6] Education
[7] Unspecified

20.4 percent of doctoral recipients just after World War II, was surpassed in 1975. Only in the physical sciences, engineering, and mathematics category has female representation in the 1970s failed to surpass previous record levels. Considering that the peak of female representation in this category was reached when women were only 16 percent of all doctoral recipients (in 1920), compared to the current approximately 29 percent of doctoral recipients, the peak in 1920 is quite remarkable.

This historical record indicates the importance of exogenous shocks such as World War II for female representation, as well as female participation in higher education. While distributional shifts of women across fields had significant impacts on within-field female representation in the 1920s, 1930s, and 1950s through 1965, the percentage of doctoral recipients who are women played a key role in the 1940s and from 1965 until the present.

One can forecast future trends based on this evidence and some knowledge of job prospects. It is likely that levels of female representation will increase overall over the next five years. As the market for women becomes saturated, and especially if affirmative action is accorded less importance than it received in the late 1970s, growth in female representation at the doctoral level will slow down substantially. The 1980s will be a period in which within-field female representation changes will be largely due to distributional changes of women across fields. If labor force participation patterns of women do not change radically, it is not reasonable to assume that female representation at the doctoral level will reach the fifty percent level, nor is it sensible for policymakers to aim for this goal. Before elaborating further

on the policy implications of this analysis two additional issues should be addressed: (1) What can one say about female representational changes across institutions granting PhD degrees, controlling for quality of the institution and (2) Do the differential employment and postdoctoral studying prospects of men and women have implications for female representation in the labor market?

An important concern when examining female representation at the doctoral level is quality of the institutions granting degrees. It is often assumed that the increase in the participation of women in graduate programs has been limited to lower quality institutions. To examine this hypothesis, we examine PhD recipients by field by Carnegie Council code category for selected years during the past decade. Schools are grouped in the following categories: (1) Research Universities I, (2) Research Universities II, (3) Doctorate-Granting I, (4) Doctorate-Granting II, (5) Comprehensive Colleges and Universities I, (6) Comprehensive Colleges and Universities II, (7) Engineering, and (8) all other.[18]

Female representation over the period from 1971 to 1978 rose for all categories of institutions primarily due to the sizable increase in the number of doctoral recipients who are women. In Table 14, we observe that, with the exception of engineering, female representation reached twenty-four or more percent in all categories of schools compared to thirteen to nineteen percent seven years earlier. Representation differs widely by field over time, with the greatest increases occurring in education at Research Universities I and II and Comprehensive

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[18] In notes on classification criteria see A Classification of Institutions of Higher Education published by the Carnegie Foundation for the Advancement of Teaching in 1976. Engineering schools are in a separate category so that they can be reviewed for the sciences.

Universities and Colleges II. The growth rate of overall female representation was greatest at Research Universities II and Comprehensive Colleges and Universities I and II, but large positive growth rates are exhibited in all categories except "other" and engineering.

Looking at distribution of women doctoral recipients within a given field across institutional categories in Table 15, we observe that except for business, the within-field share of women receiving their doctorates from the highest quality universities (Research Universities I) has declined during the 1970s. In 1971, over fifty-seven percent of women receiving doctorates received their degrees from R.U. I schools, compared to less than forty-seven percent in 1978. In most fields the chage in the distribution of women favored Doctoral-Granting and Comprehensive Colleges and Universities I, although in humanities and science, the proportion of women receiving doctoral degrees from all categories except R.U. I rose by roughly the same number of percentage points. Only in business did the R.U. I share of women PhDs increase and the shares of Doctoral-Granting I and II and comprehensive I schools fall.[19]

One should not infer from these distributional data that the expansion of enrollment of women alone has been relegated to lower quality institutions. As Table 16 indicates, males have also shifted away from R.U. I Universities. In all fields the share of R.U. I doctorates among men fell substantially except in the sciences where the decline from 1971 to 1978 was only four and one-half percent. The overall share of doctorates awarded to men declined from fifty-six percent in 1971 to forty-eight percent in 1978. Thus, the distribution shifts of men and

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[19] The share of R.U. II schools and other schools rose for business doctorates, but by only a small amount.

Table 14

FEMALE REPRESENTATION AMONG DOCTORAL RECIPIENTS
BY FIELD AND TYPE OF INSTITUTION GRANTING DOCTORATES FOR SELECTED YEARS[1]

	RESEARCH UNIV. I	RESEARCH UNIV. II	DOCTORATE GRANTING I	DOCTORATE GRANTING II	COMPREHENSIVE UNIVERSITIES AND COLLEGES I	COMPREHENSIVE UNIVERSITIES AND COLLEGES II	ENGINEERING	OTHER	TOTAL
1971									
Social Science	.177	.162	.176	.146	.190	.185		.392	.174
Humanities	.258	.273	.214	.205	.167	.250		.316	.257
Business	.026	.015	.087	.095	.050			.000	.029
Education	.209	.201	.201	.217	.217	.088		.417	.212
Sciences	.072	.064	.054	.061	.096	.100	.020	.136	.070
Other Professions	.211	.181	.103	.538	.182	.000		.054	.170
Total	.145	.133	.131	.156	.152	.134	.020	.189	.142
1973									
Social Science	.195	.212	.199	.170	.202	.185		.371	.200
Humanities	.319	.327	.253	.331	.292	.222		.343	.317
Business	.031	.031	.063	.048	.676			.000	.057
Education	.262	.237	.207	.230	.259	.196		.377	.249
Sciences	.092	.081	.088	.068	.095	.200	.032	.131	.089
Other Professions	.253	.251	.130	.440	.827	.000		.119	.213
Total	.183	.175	.158	.172	.251	.179	.032	.184	.179
1975									
Social Science	.243	.253	.230	.239	.264	.345	.000	.281	.246
Humanities	.351	.371	.370	.330	.378	.286		.369	.357
Business	.030	.048	.026	.135	.094			.000	.041
Education	.325	.318	.256	.252	.293	.418		.435	.308
Sciences	.108	.087	.084	.102	.107	.143	.056	.212	.103
Other Professions	.283	.321	.376	.233	.300	.000		.098	.209
Total	.215	.215	.200	.207	.244	.353	.056	.194	.213
1978									
Social Science	.284	.309	.344	.256	.275	.391		.414	.300
Humanities	.409	.443	.305	.350	.462	.267		.375	.406
Business	.091	.048	.159	.083	.031		.333	.143	.083
Education	.409	.397	.357	.333	.366	.423		.434	.390
Sciences	.121	.136	.093	.098	.155	.167	.024	.267	.127
Other Professions	.355	.385	.228	.211	.286			.105	.236
Total	.259	.282	.254	.243	.298	.383	.034	.245	.264

[1]A blank entry represents no Ph.D.s awarded in that field in that type of institution.

Table 15

DISTRIBUTION OF DOCTORAL RECIPIENTS WHO ARE WOMEN
ACROSS FIELDS AND TYPE OF Ph.D. GRANTING INSTITUTIONS ATTENDED FOR SELECTED YEARS

	RESEARCH UNIV. I	RESEARCH UNIV. II	DOCTORATE GRANTING I	DOCTORATE GRANTING II	COMPREHENSIVE UNIVERSITIES AND COLLEGES I	COMPREHENSIVE UNIVERSITIES AND COLLEGES II	ENGINEERING	OTHER	TOTAL
1971									
Social Science	.614	.234	.080	.037	.008	.005	.000	.021	1.000
Humanities	.678	.219	.062	.017	.005	.002	.000	.018	1.000
Business	.565	.130	.174	.087	.043	.000	.000	.000	1.000
Education	.467	.268	.122	.067	.022	.002	.000	.062	1.000
Sciences	.574	.251	.067	.027	.016	.001	.002	.062	1.000
Other Professions	.585	.176	.041	.109	.010	.000	.000	.078	1.000
Total	.574	.242	.081	.043	.014	.002	.000	.043	1.000
1973									
Social Science	.557	.255	.078	.060	.017	.004	.000	.030	1.000
Humanities	.671	.215	.051	.037	.010	.001	.000	.016	1.000
Business	.340	.113	.075	.038	.434	.000	.000	.000	1.000
Education	.476	.246	.100	.094	.032	.005	.000	.048	1.000
Sciences	.572	.223	.089	.038	.022	.001	.003	.052	1.000
Other Professions	.478	.143	.023	.028	.109	.000	.000	.216	1.000
Total	.556	.229	.077	.058	.030	.003	.001	.048	1.000
1975									
Social Science	.531	.244	.086	.073	.027	.006	.000	.032	1.000
Humanities	.615	.227	.074	.042	.021	.001	.000	.021	1.000
Business	.415	.341	.049	.122	.073	.000	.000	.000	1.000
Education	.436	.250	.105	.081	.079	.010	.000	.039	1.000
Sciences	.583	.198	.074	.055	.026	.001	.005	.060	1.000
Other Professions	.425	.200	.103	.040	.021	.000	.000	.211	1.000
Total	.520	.232	.088	.064	.042	.005	.001	.047	1.000
1978									
Social Science	.456	.249	.096	.070	.046	.005	.000	.079	1.000
Humanities	.611	.243	.054	.042	.024	.003	.000	.024	1.000
Business	.625	.153	.139	.042	.014	.000	.014	.014	1.000
Education	.368	.290	.120	.074	.088	.010	.000	.050	1.000
Sciences	.517	.265	.065	.037	.034	.001	.001	.080	1.000
Other Professions	.517	.176	.048	.033	.031	.000	.000	.194	1.000
Total	.468	.259	.089	.058	.053	.005	.000	.066	1.000

women are comparable and probably reflect the enrollment expansion at non-research universities. As noted above, female representation increased dramatically across all types of institutions.

Thus, available evidence for the 1970s does not support the hypothesis that the women have been limited to lower quality doctoral programs. The distribution of women, as well as men, has shifted away from the highest quality institutions reflecting the expansion of doctoral degree granting by lower quality institutions. However, this does imply that an increasing number of new doctorates are awarded by lower quality schools. In the case of women, where the PhD stock at the beginning of the past decade was small, this means that the current stock of doctorate holders who are women has a higher proportion of degrees awarded by lower quality schools than the stock of doctorate holders who are male. This may well be reflected in lower earnings on average and less prestigious jobs for women apart from any experience differences between men and women due to continuity of labor market experiences. When labor markets, especially for women, are tight this trend may not be in evidence, but should affirmative action requirements be relaxed or quality standards based on institution of PhD be rigorously enforced,[20] then this trend for women to be in lower paying jobs will rise.

Most doctoral recipients go to work after completing a degree, although the proportion studying and not working after degree completion is rising. Table 17 indicates how the patterns of postdoctoral plans have changed for men and women over the past decade. While the propor-

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[20] If quality of PhD-granting institution is correlated with future productivity, then any quality standards to which institutions strictly adhere, will have the same impact as standards based on institutions origin of PhD

Table 16
DISTRIBUTION OF DOCTORAL RECIPIENTS WHO ARE MEN ACROSS FIELDS AND TYPE OF Ph.D. GRANTING INSTITUTION ATTENDED FOR SELECTED YEARS

	RESEARCH UNIV. I	RESEARCH UNIV. II	DOCTORATE GRANTING I	DOCTORATE GRANTING II	COMPREHENSIVE UNIVERSITIES AND COLLEGES I	COMPREHENSIVE UNIVERSITIES AND COLLEGES II	ENGINEERING	OTHER	TOTAL
1971									
Social Science	.602	.255	.079	.046	.007	.005	.000	.007	1.000
Humanities	.672	.202	.079	.023	.009	.002	.000	.013	1.000
Business	.632	.255	.054	.024	.024	.000	.000	.010	1.000
Education	.476	.288	.120	.065	.022	.006	.000	.023	1.000
Sciences	.558	.275	.087	.031	.012	.001	.008	.029	1.000
Other Professions	.450	.164	.074	.019	.010	.003	.000	.280	1.000
Total	.561	.262	.089	.038	.013	.003	.004	.031	1.000
1973									
Social Science	.577	.237	.079	.074	.017	.004	.000	.013	1.000
Humanities	.664	.205	.070	.034	.011	.002	.000	.014	1.000
Business	.645	.215	.068	.046	.013	.000	.000	.014	1.000
Education	.443	.262	.127	.104	.030	.007	.000	.027	1.000
Sciences	.550	.247	.089	.051	.020	.000	.010	.034	1.000
Other Professions	.384	.117	.041	.010	.006	.006	.000	.436	1.000
Total	.541	.236	.089	.061	.019	.003	.004	.046	1.000
1975									
Social Science	.539	.235	.094	.076	.025	.004	.000	.027	1.000
Humanities	.630	.213	.070	.047	.019	.002	.000	.019	1.000
Business	.572	.284	.076	.033	.030	.000	.000	.005	1.000
Education	.403	.240	.136	.107	.085	.006	.000	.023	1.000
Sciences	.554	.238	.093	.056	.025	.001	.009	.025	1.000
Other Professions	.284	.111	.045	.035	.013	.002	.000	.510	1.000
Total	.514	.229	.096	.067	.035	.002	.004	.053	1.000
1978									
Social Science	.492	.239	.078	.088	.052	.003	.000	.048	1.000
Humanities	.602	.209	.085	.053	.019	.005	.000	.027	1.000
Business	.566	.277	.067	.042	.039	.000	.003	.008	1.000
Education	.340	.281	.138	.095	.097	.009	.000	.042	1.000
Sciences	.544	.245	.092	.050	.027	.001	.009	.032	1.000
Other Professions	.290	.087	.051	.038	.024	.000	.000	.510	1.000
Total	.480	.236	.094	.065	.045	.003	.004	.073	1.000

tion of male doctoral recipients who are studying rose from eleven percent in 1968 to almost nineteen percent in 1979, the proportion of female doctoral recipients studying only rose from 10.7 to fifteen percent over the same period. Undoubtedly some of the differential growth rate in the proportion studying reflects the relative job opportunities for men and women. Among those who study the proportions receiving fellowships have declined for both sexes, whle the proportion receiving research assistanships has increased. Women are less likely to have post-doctoral research assistanships, possibly due to the smaller proportion of women in science relative to the proportion of men in this field.

Although the number of women employed in educational institutions after completion of a doctoral degree has increased, the proportion of female PhD recipients employed by educational institutions declined from almost 63 percent in 1968 to almost 53 percent in 1979. The proportion of men earning doctorates who were employed in this sector fell almost 13 percentage points from 1968 to 1979 to 43.3 percent. The proportions of men and women doctoral recipients employed in government, industry and nonprofit organizations grew while the proportion in the "other" category fell. In industry, where women are traditionally underrepresented, the proportion of women doctoral recipients grew from 2.4 percent to 6.6 percent, compared to an increase in the proportion of men from 13.1 to only 14.2 percent from 1968 to 1979. Affirmative action and other factors have increased the employment opportunities for women in the industrial sector, but because the stock of all (not just recent) PhDs in industry who are men is fairly large, female representation in this sector will improve slowly. In all these employment sectors, the

Table 17 PLANNED POSTDOCTORAL ACTIVITY OF DOCTORAL DEGREE RECIPIENTS, 1968-1979

POSTDOCTORAL ACTIVITY	1968		1970		1972		1973		1974		1975		1976		1977		1978		1979	
	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN
NUMBER	2,913	19,925	3,972	25,527	5,282	27,719	6,082	27,645	6,415	26,585	7,193	25,720	7,676	25,247	7,845	23,827	8,313	22,537	8,921	22,279
DISTRIBUTION ACROSS ACTIVITIES:																				
(1) STUDY by Type of Support	10.7	11.0	13.0	14.8	12.5	16.0	13.6	16.0	13.4	15.3	13.8	16.4	13.2	17.6	14.3	17.9	14.4	19.2	15.0	18.9
(a) Fellowship	8.9	9.7	7.9	8.0	6.2	7.6	7.3	7.5	6.4	6.9	7.4	7.4	7.3	8.3	7.7	8.5	7.9	9.2	8.2	9.1
(b) Research Assistanship	--	--	3.4	5.6	3.6	6.5	3.7	6.5	4.2	6.3	4.2	6.9	3.5	7.1	4.3	7.4	3.8	7.6	4.3	7.2
(c) Traineeship	1.5	1.0	0.7	0.5	1.0	.6	.7	.5	.8	.6	.8	.6	.7	.6	.7	.8	.9	.9	1.0	1.0
(d) Other	0.3	0.2	1.0	0.7	1.7	1.3	1.9	1.5	2.0	1.5	1.4	1.5	1.8	1.6	1.6	1.3	1.8	1.5	1.5	1.6
(2) EMPLOYMENT by Sector	85.3	85.2	81.2	80.9	79.1	77.4	78.6	78.3	78.3	77.4	78.3	77.4	78.8	75.8	77.0	74.9	76.2	73.7	77.3	74.1
(a) Educational Institutions	62.9	56.1	65.6	54.9	63.6	53.7	60.3	52.4	60.4	49.5	59.2	49.8	59.2	49.3	57.3	46.8	54.9	44.8	52.9	43.3
(b) Industry	2.4	13.1	2.5	13.2	2.3	8.7	3.1	10.3	3.1	11.4	3.8	11.2	3.8	10.2	4.0	11.3	5.5	12.5	6.6	14.2
(c) Government	3.9	5.8	4.6	7.6	4.3	9.6	5.6	8.9	5.2	9.8	5.7	9.8	6.0	9.5	6.5	10.0	6.2	9.4	7.3	9.7
(d) Nonprofit Organizations	3.5	2.7	3.2	2.8	3.3	2.6	3.4	1.3	3.3	3.3	3.9	3.6	4.0	3.8	4.5	3.9	4.8	4.2	5.1	4.2
(e) Other	12.6	7.5	5.3	2.4	5.6	2.8	6.2	3.4	6.3	3.4	5.8	3.0	5.7	2.9	4.8	2.9	4.9	2.8	4.1	2.7
(3) UNKNOWN STATUS	4.0	3.8	5.8	4.3	8.4	6.6	7.7	5.7	8.3	7.3	7.8	6.2	8.0	6.7	8.7	7.2	9.4	7.1	7.7	6.9
STATUS OF POSTGRADUATE PLANS:																				
(1) Definite Postdoctoral Study	--	--	--	--	--	--	9.2	11.9	9.0	10.9	9.7	12.1	9.2	13.0	9.7	13.1	9.8	14.4	10.8	14.5
(2) Seeking Postdoctoral Study	--	--	--	--	--	--	4.5	4.1	4.3	4.4	4.2	4.3	4.0	4.6	4.6	4.9	4.6	4.8	4.3	4.4
(3) Definite Employment	--	--	--	--	--	--	52.7	60.8	52.2	59.0	52.1	58.5	52.3	56.1	51.1	55.1	50.4	54.7	51.2	55.3
(4) Seeking Employment	--	--	--	--	--	--	25.9	17.4	26.0	18.4	26.2	19.0	26.5	19.7	25.9	19.8	25.8	19.0	26.0	18.8
(5) Unknown	--	--	--	--	--	--	7.7	5.7	8.3	7.3	7.8	6.2	8.0	6.7	8.7	7.2	9.4	7.1	7.7	6.9

influx of women is large; however, because these women lack job experience, their impact on representation at senior levels will be small.[21]

To summarize the postdoctoral opportunities confronting women, one can say that the opportunities for women in most areas have improved, although this may be a temporary phenomenon. It may reflect the growth of higher education as an employer,[22] which will not be the case during the 1980s, and the impact of affirmative action and declining discrimination which has been discussed in previous sections. The "seek" variable, defined as the proportion of PhD receipients still seeking employment when completing the Doctoral Records File questionnaire has not changed much for women over the past decade, but it has increased for men. Furthermore, as noted above, the rising proportion of men studying may reflect reduced employment opportunities.

The analysis of doctoral recipients implies that female representation, in the absence of policy changes, will grow and level off. If the current distribution of women doctoral recipients across fields persist, then policies (e.g., special scholarships) to increase overall levels of female participation in doctoral programs will exacerbate the problems of excess supply of highly trained women. The social costs of such policies will outweigh the social benefits. Furthermore, the existence of a cohort of frustrated, underutilized, highly trained women doctoral recipients may cause an overreaction by younger cohorts who will seriously underinvest in doctoral training. Even in the absence of these poli-

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[21] A detailed look at academe in this context follows in the faculty section of this paper.

[22] The proportion of doctoral recipients in this sector declined, but the absolute numbers hired increased.

cies, imbalances may still occur for women in the future, especially considering that over half of new doctoral recipeints who are women become employed in the education sector which will be growing slowly, if not declining, over the next decade.

Much of the favorable increases in female representation have resulted from changes in labor market rewards for women. To some extent, as women increase their labor market commitment, these factors, in the absence of policy changes, will continue to favor increases in female representation. Offsetting this will be the declining rewards to doctoral degrees in "traditionally" female fields. Another factor to be considered is the educational distribution by age of women. Some of the rising number of PhD acquisitions by women represents a return of older women to school. Because younger cohorts may have already acquired doctoral degrees when they reach their forties, there may be a decline in the participation of older women in doctoral programs. Again this requires no policy action and may be an efficient adjustment even if female representation declines slightly as a result. Because the ultimate policy goal is not just to increase the representation of women students, but to increase representation among faculties, business professionals, and others, policies should favor younger not older women. For older women, the time that they are likely to spend in the labor force is less than that for younger women. Thus, the period over which they contribute productive services and to female representation will be shorter.[23]

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[23] If two women age 35 and age 45 complete PhDs at the same time and both retire at age 65, the younger woman will have a working life that is 10 years longer. Thus, female representation could be higher for 30 rather than 20 years.

If policies to raise representation are desired, a policy that encourages more continuous labor force particpation over time for younger women is probably the best. This will have the highest social payoff in terms of productive use of resources and in terms of stabilizing and increasing levels of female representation both among graduate students and among workers in all sectors. Another feature of such a policy might be to encourage women to move to "traditionally male" fields in which shortages of doctoral recipients can be expected to continue. Engineering and computer science are two fields in which this policy may be useful. Because rewards are higher in these fields it may cost less to induce women to switch to these fields; however, there are also high opportunity costs for women in these fields which offset this factor. A possible alternative to a subsidy policy is a policy which provides more information to potential women graduate students about the returns in these fields. Information would have to be provided early in the undergraduate careers of these women so that they could adequately prepare for graduate study in these areas. As noted earlier, the lags in PhD acquisition make rapid changes impossible, and a long run policy perspective is required. These lags also may obscure the fact that some of these field changes have begun already.

An argument for a necessity of policies to encourage or force research research universities to train more women doctorates is not well founded. Women do not seem to have been limited to attending lower quality schools; the distributions of men and women doctoral recipients across colleges classified by Carnegie Council code is quite similar and both distributions have chaged in comparable directions over the past

decade (i.e., nonresearch universities have increased PhD production). Because the stock of doctoral holders who are women has increased so dramatically over the past decade, women, on average, may have degrees from "lower quality" institutions than men. This may be a problem in the near term, especially as labor markets become saturated, but government intervention cannot ameliorate this problem easily.

SECTION 5

PROFESSIONAL DEGREES, 1968 TO 1978

The number of women receiving first professional degrees was nine times as large in 1978 as it was in 1968. During that same time period the number of first professional degrees awarded to both sexes together only doubled. Consequently, female representation rose in all fields[24] during this period. Overall female representation rose from less than five percent to over twenty-one percent. Across fields, female representation varied from eleven to twenty-six percent in 1978 compared to one and one-half to less than eight percent in 1968 (see Table 18). Most of the within-field increases in representation are attributable to the overall increase in female participation in professional programs. However, some of these within-field increases during the first five years of this period, especially in law, were significantly altered by changes in the distribution of women across fields.[25]

Much of the dramatic increase in female representation took place between 1973 and 1978. This reflects a substantial increase in the growth rate of women receiving first professional degrees at a time when the growth rate of awards of first professional degrees declined. For

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[24] The professional degrees examined are grouped into five areas: dentistry, medicine (including osteopathy), medicine-other (including podiatry, optometry, and veterinary medicine), law, and all other (primarily theology).

[25] In many cases the impact of the changes in female distribution over this period, in fields other than law, was negative.

TABLE 18

Female Representation Among Professional Degree Recipients, 1968 to 1978

Field	Percent Female 1968	Percent Female 1973	Percent Female 1978
Dentistry	1.5	1.4	11.2
Medicine	7.7	8.7	21.0
Medicine - Other	7.2	6.6	16.5
Law	4.1	8.1	26.0
Other*	2.6	3.9	11.3
TOTAL	4.7	7.2	21.5

* Primarily Theology

women, the number of first professional degrees awarded grew by one hundred and twenty percent from 1968 to 1973, and by three hundred percent from 1973 to 1978. During these same time periods, the number of men receiving first professional degrees rose fifty-eight percent and twelve percent respectively (see Table 19).[26] The total number of women

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[26] The total number of first professional degrees awarded rose by forty-six percent during the first period and thirty-three percent in the second period.

receiving professional degrees over the entire six year period from 1968 to 1973 is approximately equal to the number of women receiving professional degrees in 1978. Thus, the recent changes have had a substantial impact of the supply on women with professional degrees. Because this group of women lacks seniority, females are undoubtedly still underrepresented in positions of power in the workplace and in professional societies. It is likely that women are underrepresented at administrative levels as well. However, over time, these characteristics of the labor market and professional groups will change in response to the influx of young women professionals. Because women are currently underrepresented in all the professions examined, this improvement in the status of women may be slow. As the market for specific professions become saturated because demand does not keep pace with supply (e.g., in law),[27] a more pessimistic prognosis may be appropriate.

The patterns of female representation within fields is markedly different (see Table 20). In both dentistry and medical-other professions, female representation declined by a small amount between 1968 and 1973. Female representation in the remaining fields, particularly in law began to increase rapidly during the first period. Between 1973 and 1978, female representation increased significantly in all fields. The gains for representation were quite dramatic in most fields, although in medicine and other-medical, the changes were more gradual.

Examining the changes in within-field representation over these two periods in detail, one observes that the two key factors are increases in overall female representation at the professional degree level and

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[27] This may be temporarily exacerbated by changes in the age of mandatory retirement.

Table 19

NUMBER AND PERCENTAGE DISTRIBUTION OF PROFESSIONAL DEGREES AWARDED TO MEN 1968 TO 1978

Field	1968	1969	1971	1973	1975	1977	1978
Dentistry	3,395 (10.3%)	3,400 (10.1%)	3,731 (10.4%)	4,028 (8.6%)	4,660 (9.5%)	4,804 (9.1%)	4,652 (8.9%)
Medicine	7,767 (23.6%)	7,882 (23.3%)	8,618 (24.1%)	9,967 (21.3%)	11,526 (23.4%)	11,751 (22.3%)	12,125 (23.1%)
Medicine - Other	1,812 (5.5%)	1,736 (5.1%)	1,907 (5.3%)	2,194 (4.7%)	2,289 (4.6%)	4,176 (7.9%)	4,509 (8.6%)
Law	16,008 (48.7%)	16,585 (49.0%)	16,359 (45.7%)	25,260 (53.9%)	25,042 (50.9%)	26,618 (50.5%)	25,622 (48.8%)
Other*	3,910 (11.9%)	4,227 (12.5%)	5,182 (14.5%)	5,378 (11.5%)	5,713 (11.6%)	5,319 (10.1%)	5,645 (10.7%)
Total	32,892 (100%)	33,830 (100%)	35,797 (100%)	46,827 (100%)	49,230 (100%)	52,668 (100%)	52,553 (100%)

*Primarily Theology

Table 20

NUMBER AND PERCENTAGE DISTRIBUTION OF PROFESSIONAL DEGREES AWARDED TO WOMEN 1968 TO 1978

Field	1968	1969	1971	1973	1975	1977	1978
Dentistry	53 (3.2%)	37 (2.3%)	46 (1.9%)	58 (1.6%)	149 (2.1%)	383 (3.2%)	586 (4.1%)
Medicine	647 (39.7%)	627 (39.8%)	840 (33.9%)	954 (26.4%)	1,689 (24.0%)	2,675 (22.1%)	3,218 (22.3%)
Medicine - Other	141 (8.6%)	77 (4.9%)	116 (4.7%)	154 (4.3%)	269 (3.8%)	744 (6.1%)	891 (6.2%)
Law	684 (41.9%)	723 (45.9%)	1,293 (52.2%)	2,224 (61.6%)	4,455 (63.4%)	7,745 (63.9%)	8,994 (62.4%)
Other*	106 (6.5%)	111 (7.0%)	184 (7.4%)	218 (6.0%)	467 (6.6%)	565 (4.7%)	722 (5.0%)
Total	1,631 (100%)	1,575 (100%)	2,479 (100%)	3,608 (100%)	7,029 (100%)	12,112 (100%)	14,411 (100%)

*Primarily Theology

changes in the distribution of women across fields. In table 21, the decomposition is depicted in detail. The most important results documented in this table are the magnitude of distributional changes on female representation in law in 1968 to 1973, but not in 1973 to 1978, the large adverse impact of distributional shifts on the scientifically oriented professions from 1968 to 1973, and the extraordinarily large impact of increases in overall female representation in the later period.[28]

Despite the improvements over the last decade, even in law, female representation is significantly below thirty percent in each of the fields, as well as overall.

Many of the causes of low female representation at the PhD level are responsible for lower levels of representation at the professional degree level. To be successful in these professional fields, a period of practice is required after lengthy study, and many women who do not wish to postpone childbearing may be deterred from entering these fields. Because of the magnitude of the investment, a long payback period is necessary for a profitable return; for women who anticipate intermittent labor force participation due to childbearing and care, this investment maynot be profitable due to the abbreviated payback period. Other factors including women's tastes and discrimination against women have also undoubtedly played a role in suppressing the

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[28] Of some interest is the magnitude of the effect of some of the interaction terms in dentistry and other medical. During the period 1973 to 1978 for example, the interaction between ΔP and ΔQF was almost as large as the sum of the main effects of each of these factors. Ignoring the small three way interaction term, the total effect of the simultaneous change in ΔP and ΔQF on female representation in dentistry was magnified because both factors changed at the same time.

Table 21. DECOMPOSITION OF THE CHANGES IN FEMALE REPRESENTATION BY FIELD AMONG PROFESSIONAL DEGREE RECIPIENTS BY CAUSAL FACTOR

	TOTAL CHANGE IN THE PERCENT OF DEGREE RECIPIENTS WHO ARE WOMEN	PART OF TOTAL CHANGE DUE DIRECTLY FROM ONLY ΔP[1]	PART OF TOTAL CHANGE DUE DIRECTLY FROM ONLY ΔQm[2]	PART OF TOTAL CHANGE DUE DIRECTLY FROM ONLY ΔQf[3]	PART OF TOTAL CHANGE DUE TO THE INTERACTION OF ΔP AND ΔQm	PART OF TOTAL CHANGE DUE TO THE INTERACTION OF ΔP AND ΔQf	PART OF TOTAL CHANGE DUE TO THE INTERACTION OF ΔQm AND ΔQf	PART OF TOTAL CHANGE DUE TO THE INTERACTION OF ALL THREE FACTORS ΔP, ΔQm, ΔQf
1968-1973								
Dentistry	- 0.12	0.83	0.30	- 0.77	0.16	- 0.41	- 0.15	- 0.08
Medicine	1.05	3.76	0.77	- 2.42	0.33	- 1.08	- 0.23	- 0.07
Medical-Other	- 0.66	3.55	1.16	- 3.52	0.50	- 1.63	- 0.54	- 0.19
Law	4.00	2.12	- 0.39	1.82	- 0.19	0.85	- 0.16	- 0.06
Other[4]	1.21	1.42	0.09	- 0.23	0.05	- 0.12	- 0.01	- 0.00
1973-1978								
Dentistry	9.77	3.46	- 0.04	2.09	- 0.09	4.51	- 0.06	- 0.10
Medicine	12.24	16.67	- 0.62	- 1.26	- 0.88	- 1.81	0.08	0.05
Medical-Other	9.94	13.43	- 2.87	2.67	- 5.12	3.91	- 1.10	- 1.00
Law	17.89	15.77	0.78	0.09	1.10	0.13	0.01	0.00
Other[4]	7.44	8.71	0.26	- 0.64	0.50	- 1.28	- 0.04	- 0.06

[1] ΔP - Change in the percent of all bachelor degree recipients who are women.
[2] ΔQm - Change in the distribution across fields of male degree recipients.
[3] ΔQf - Change in the distirbution across fields of female degree recipients.
[4] Primarily theology.

supply of women with professional degrees. As child care patterns, tastes, and discrimination have changed, the level of female participation in professional programs has risen and can be expected to rise in the future. It is unrealistic to expect female representation to attain a fifty percent level in this area until there is a more universal, radical change in child care arrangements that results in a more continous labor force participation profile (and thus longer payback period) for women.

The calculation of a social rate of return to professional education is comparable to the private one in the sense that the profitability is determined by the length of the payback period. Society could subsidize the costs of a professional education for women if jobs were available, but this action would not be warranted unless the social benefits of the gain in representation outweigh the costs of the lost earnings of individuals when they are out of the labor force.[29]

One difference between PhD acquisition and professional degree acquisition which influences the policy recommendations is the level of market saturation and prospects for the future. With the exception of the legal profession, the outlook for the professions is substantially better than for many occupations requiring a PhD. Thus, the expected problems associated with a saturated market for doctoral recipients are less significant for the professions, at least in the short run. The policymaker should, however, bear in mind the discussion of the lower

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[29] One could belabor this point somwehat with a discussion of subsidies for women to remain single or childless and gain a professional degree because continous labor force participation can be expected from these women. However, it certainly is not clear that government intervention in this sphere is appropriate.

payback period. The provision of day care may be a better investment from society's point of view, than subsidies for women to enter the professions, but the impact on the labor force commitments on well-paid women professionals may be minimal. Most policies of this type are beyond the purview of educational policymakers, but there is a need for a coordinated policy from the federal government.

SECTION 6

FEMALE REPRESENTATION ON ACADEMIC FACULTIES, 1972 TO 1979

As noted in an earlier section, female representation at the lower faculty ranks increased substantially as a consequence of the dramatic rise in the supply of PhD holders who are women.[30] Higher education expanded rapidly during this period, and faculties swelled correspondingly. Over forty-eight thousand additional persons augmented the existing faculty stocks representing an increase in the size of the stock of more than eight and one-half percent from 1972 to 1979.

The growth in U.S. faculties was not uniform across ranks, tenure status, sex, nor institution types. The most dramatic increases by rank were for lectures (a fifty-six percent increase) and for associate and full professors (both increased more than forty percent). The number of assistant professors rose by six percent between 1972 and 1975, but then declined continuously between 1975 and 1979 so that the increase over the entire period was only one and one-half percent. The number of instructors and unranked individuals increased by eight percent.[31] Thus, much of the growth in faculty slots took place at the full and associate professor level in which women have been traditionally underrepresented,

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[30] All results reported here are for full time faculty appointments only.

[31] Due to a reporting change between 1976 and 1977, many individuals formerly designated as instructors (before 1977) were desegregated as unranked after 1977. When results are discussed, these two groups will be analyzed together to avoid analyzing spurious changes due to reporting changes.

but also in which the supply of qualified women was probably not adequate to meet the demand for them.

Fewer than ten percent of full professors are women, and fewer than twenty percent of associate professors are women. Furthermore, female representation during this period of expansion of higher education progressed very slowly in these two ranks. Female representation only rose by one-half of one percent at the full professor level (and by zero percent for tenured full professor levels) and by three and one-half percent at the associate professor level (a little over two percent at the tenured associate level).

At the assistant professor level, the trends are quite different. While the number of assistant professors peaked in 1975, the number of assistant professors who are women rose steadily throughout the 1970s. The number of women assistant professors rose by over fifty percent from 1972 to 1979, while the total number of assistant professors only rose by one and one-half percent. Thus, higher education demonstrated a capacity to increase female representation without increasing the size of the group. By 1979, female representation reached almost thirty-three percent compared to less than twenty-two percent seven years earlier. However, it is notable that female representation among tenured assistant professors rose less rapidly than representation among nontenured assistant professors.

Representation increased significantly at the lowest ranks (lecturers, instructors, and unranked faculty members). The number of lecturers rose well over fifty percent between 1971 and 1979, and female representation for that group rose from thirty-seven percent to almost

forty-four percent. For unranked faculty members and instructors, female representation rose six percentage points to reach forty-one and one-half percent in 1979. The gains in female representation were comparable for lecturers and the unranked-instructors groups, despite the fact that the growth in the number of lecturers substantilly exceeded the growth rate of unranked faculty members and instructors.

Thus, one of the most surprising results of this analysis is that the growth rates of female representation within ranks do not seem to be associated with the growth rate of their respective ranks, even at the lowest ranks. As a group expands, it should be easier to increase the ratio of minority to majority individuals because the number of majority positions can be held constant while the number of minority positions can be increased.[32] Whether this lack of correlation between growth and female representation which we observe during the expansion of higher education will be sustained in a period of contraction of this sector is still open to question.

A serious problem for female representation at the senior level in the future may be the drastically reduced hiring levels and tenure granting that are expected in response to enrollment declines. When relatively few new individuals are being added to a group which is overwhelmingly composed of majority individuals, it is difficult to significantly alter the ratio of minority of majority individuals. Thus, female representation at the full professor level is likely to increase quite slowly over the next decade. A complicating factor is that much of the increased supply of women doctorates who joined the ranks of aca-

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[32] Thus, the majority does not feel that the minority is gaining at the expense of the majority.

deme in the 1970s will be coming up for tenure review and promotion at approximately the same time as colleges and universities are reducing hiring, promotions, and granting tenure both in response to reduced enrollments and because addition of senior faculty will be slowed, due to the change in the age of mandatory retirement.[33] It is quite possible that the flow of women into senior positions as predicted by Fernandez[34] and others will not materialize. In part these studies ignore the longer period of time between PhD acquisition and promotion to full professor for women who tend to participate in the labor force more intermittently than their male counterparts, and ignore possible feedback effects (see the discussions of exogenous and endogenous labor supply responses in earlier sections of this paper) which will occur when markets become saturated and economic rewards in academe are reduced. Even the most optimistic forecast of Fernandez for tenured faculty leaves female representation below thirty percent by the year 2000.[35]

Other factors may exacerbate underrepresentation in the future. One factor is the reduced levels of junior faculty hiring that are expected over the next decade. This may erode the progress women have made, and to the degree to which the academic market becomes relatively saturated, women may either leave academe or leave the labor market altogether. Future cohorts will be less likely to undertake substantial

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[33] This issue was discussed in "Addendum to Implications for the Natural Sciences of the 1982 Increase in the Mandatory Retirement Age to 70," mimeo dated 1/11/80.

[34] U.S. Faculty After the Boom: Demographic Projections to 2000, April 1978.

[35] My most pessimistic projection for the year 2000 is significantly below the twenty-two percent forecast that Fernandez gives as a lower bound example for tenured faculty.

training investments as well. Thus, the supply of women junior faculty to be promoted may be smaller than it currently is. A second factor is the potential reluctance of higher education to comply with affirmative action in a period of declining activity.[36] Finally a third related factor that may exacerbate underrepresentation is the distribution across types of institutions. Women faculty are disproportionately represented in the lower quality, less prestigious (as measured for example, by Carnegie Classification Code) institutions which are more susceptible to declining enrollments and revenues.[37]

Table 22 details the pattern of female representation by rank across time and types of institutions.[38] Two year colleges have maintained a traditionally higher ratio of women to men faculty at all levels. Many of the significant increases in female representation occurred across all institution types. At the assistant professor level, representation rose approximately ten percentage points between 1972 and 1979 except at two year branches of colleges and universities. Universities have lagged behind in female representation, especially at the

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[36] See Beller's example in The Impact of Equal Employment Opportunity Laws on Male/Female Earnings Differentials, in Lloyd et. al. (eds), Women in the Labor Market (N.Y.: Columbia University Press, 1980) and the fear of a backlash effect when jobs are scarce in Wallace's Impact of Equal Employment Opportunity Laws in Kreps (ed) Women and the American Economy (Englewood Cliffs, N.J.: Prentice Hall, 1976). The seniority and tenure systems of academe facilitates perpetuation of underrepresentation at least as much as the seniority system in unionized sectors of the economy.

[37] As noted in a previous section, the current stock of who have their degrees from lower quality schools is higher for women than it is for men. Furthermore, this proportion is growing.

[38] Patterns across institutions classified by sex, control, and other factors was also examined, but not reported here for the sake of brevity. Readers interested in these results should contact the author.

higher levels (full and associate professors) in all years. The patterns which existed at the full and associate professor ranks across institution types have changed comparatively little. Increases in overall representation seem to raise the level of representation in each institution class, but there is no evidence for either the proposition that universities by increasing the hiring of women are causing levels of representation at lower quality institutions to fall, nor for the proposition that universities are increasing female representation significantly more quickly or more slowly than other types of institutions.

The foregoing analysis is somewhat pessimistic about the opportunities for increasing female representation at the senior level over the next twenty years. The prognosis for the junior faculty level is brighter, but nevertheless uncertain. In any case, the issues are long run persistent problems that cannot be ameliorated easily with short term policy initiatives. Short run policy changes to encourage more junior faculty may only result in an increased supply of frustrated women trained for senior positions in academe which are nonexistent. This could potentially cause future cohorts of women to be excessively discouraged about prospects in academe and thus cause fewer women to choose academic careers.

Federal assistance for senior faculty hiring will be quite expensive if it is to be effective given the current structure of higher education. When a school grants tenure, the commitment is expected to last over a long period of time. Any federal support to encourage the hiring of women would either have to be of equal expected length and of substantial magnitude. The costs of such a program should be compared to

Table 21

TOTAL NUMBER OF FACULTY MEMBERS AND PROPORTION OF

FACULTY WHO ARE FEMALE BY RANK, TENURE STATUS AND INSTITUTION TYPE 1972-79

Rank/Tenure Status/Institution Type	1972	1973	1975	1976	1977	1978	1979
Total			568,285(21.8)	573,680(22.2)	604,571(22.7)	611,237(23.0)	616,707(23.5)
Full Professors (Total)	68,914 (9.1)	73,574 (9.3)	84,199 (9.8)	85,221 (9.5)	89,710 (9.3)	93,042 (9.5)	97,936 (9.6)
Universities	35,495 (5.6)	36,665 (5.9)	39,677 (6.2)	40,069 (5.8)	42,077 (5.9)	42,958 (5.9)	45,081 (5.9)
Other Four Year Colleges	29,257(12.0)	31,106(11.7)	35,991(12.0)	36,609(11.9)	39,067(11.8)	41,030(11.8)	42,859(12.1)
Two Year Colleges	2,148(21.6)	3,404(22.2)	4,474(24.3)	4,376(22.0)	3,752(20.5)	4,298(21.0)	4,806(21.4)
Four Year Branches of Universities	1,996(12.9)	2,345(12.5)	3,978(10.3)	4,093(10.7)	4,704(10.5)	4,676(10.3)	5,085(10.5)
Two Year Branches of Universities	14 (0.0)	22 (0.0)	42 (9.5)	39(17.9)	59(28.8)	71(25.4)	94(24.5)
Two Year Branches of Four Year Colleges	4(25.0)	32(15.6)	37(13.5)	35(14.3)	51(17.6)	9(11.1)	11 (9.1)
Full Professors (Tenured ONLY)			77,777 (9.4)	78,342 (9.3)	83,514 (9.1)	86,477 (9.3)	88,291 (9.4)
Universities			38,043 (6.0)	37,693 (5.7)	39,473 (5.8)	40,820) (5.9)	41,635 (5.8)
Other Four Year Colleges			32,154(11.8)	33,211(11.7)	36,195(11.6)	37,365(11.7)	37,690(11.9)
Two Year Colleges			3,707(23.2)	3,795(21.8)	3,303(20.6)	3,768(20.9)	4,064(21.5)
Four Year Branches of Universities			3,808(10.1)	3,582(11.0)	4,436(10.3)	4,444(10.1)	4,799(10.4)
Two Year Branches of Universities			41 (9.8)	37(18.9)	59(28.8)	71(25.4)	92(25.0)
Two Year Branches of Four Year Colleges			24(16.7)	24(16.7)	48(16.7)	9(11.1)	11 (9.1)
Associate Professors (Total)	68,487(15.5)	73,558(15.9)	84,387(16.9)	86,530(17.1)	91,436(17.6)	94,286(18.2)	96,583(18.9)
Universities	28,739(11.4)	30,245(12.1)	32,059(13.0)	31,995(13.2)	33,333(13.7)	33,870(14.4)	34,684(15.1)
Other Four Year Colleges	32,701(17.7)	34,784(17.7)	40,635(18.2)	41,906(18.3)	44,504(18.6)	45,655(18.9)	46,543(19.7)
Two Year Colleges	4,347(23.0)	5,148(23.4)	6,605(25.1)	7,249(25.0)	7,439(26.2)	8,491(26.9)	8,799(27.8)
Four Year Branches of Universities	2,447(20.6)	3,008(19.1)	4,545(18.2)	4,798(18.9)	5,461(19.8)	5,628(20.2)	5,852(20.3)
Two Year Branches of Universities	228(23.7)	278(24.1)	395(30.1)	441(28.1)	537(29.4)	580(29.3)	643(30.0)
Two Year Branches of Four Year Colleges	25(44.0)	95(34.7)	148(29.7)	141(30.5)	162(30.9)	62(33.3)	62(33.9)

TOTAL NUMBER OF FACULTY MEMBERS AND PROPORTION OF

FACULTY WHO ARE FEMALE BY RANK, TENURE STATUS, AND INSTITUTION TYPE 1972-79

RANK/TENURE STATUS/INSTITUTION TYPE	1972	1973	1975	1976	1977	1978	1979
Associate Professors (Tenured ONLY)			66,005(16.7)	68,175(16.9)	73,309(17.2)	75,601(17.8)	74,866(18.5)
Universities			26,193(12.8)	25,935(12.9)	26,989(13.4)	27,834(14.1)	27,330(14.8)
Other Four Year Colleges			30,546(18.3)	32,268(18.3)	35,143(18.2)	35,703(18.5)	35,107(19.2)
Two Year Colleges			5,173(25.1)	5,758(25.2)	6,068(26.1)	6,816(26.7)	6,871(27.5)
Four Year Branches of Universities			3,659(17.2)	3,713(18.5)	4,478(18.9)	4,661(19.8)	4,932(19.8)
Two Year Branches of Universities			338(30.5)	394(28.9)	489(30.1)	537(29.6)	588(30.4)
Two Year Branches of Four Year Colleges			96(32.3)	107(29.0)	142(28.2)	50(32.0)	38(34.2)
Assistant Professors (Total)	100,614(21.8)	104,338(23.6)	106,667(27.2)	104,215(28.8)	104,886(30.2)	103,122(31.6)	102,087(32.9)
Universities	35,883(17.1)	36,313(19.4)	34,472(23.5)	33,245(25.1)	34,010(26.7)	33,437(28.3)	33,754(29.1)
Other Four Year Colleges	51,357(23.6)	52,406(24.8)	53,970(27.9)	52,449(29.3)	52,227(30.7)	50,992(32.0)	50,048(33.6)
Two Year Colleges	8,582(28 7)	9,754(30.5)	10,692(34.3)	10,877(35.9)	10,567(37.3)	10,932(38.3)	10,645(39.3)
Four Year Branches of Universities	3,991(26 6)	4,680(27.3)	6,061(28.1)	6,228(31.4)	6,582(32.5)	6,352(34.8)	6,207(36.6)
Two Year Branches of Universities	712(23.6)	958(25.9)	1,160(29.6)	1,108(28.5)	1,252(29.2)	1,278(30.8)	1,290(30.3)
Two Year Branches of Four Year Colleges	89(38.2)	227(33.5)	312(35.3)	308(34.4)	248(39.1)	131(40.5)	143(41.3)
Assistant Professors (Tenured ONLY)			29,431(32.0)	29,526(32.7)	30,345(33.5)	30,170(34.2)	28,043(35.9)
Universities			6,117(31.2)	5,948(32.4)	5,922(33.7)	5,805(34.2)	5,441(35.4)
Other Four Year Colleges			16,378(31.6)	16,393(32.0)	16,955(32.6)	16,514(33.1)	15,193(35.2)
Two Year Colleges			5,226(32.9)	5,428(33.6)	5,527(34.6)	5,983(36.2)	5,521(37.3)
Four Year Branches of Universities			1,229(37.7)	1,286(39.9)	1,325(38.9)	1,321(40.9)	1,353(40.9)
Two Year Branches of Universities			378(27.8)	331(25.1)	466(30.9)	479(30.9)	484(30.6)
Two Year Branches of Four Year Colleges			103(35.0	140(37.1)	150(41.3)	68(42.6)	51(47.1)
Lecturers (Total)	3,790(37.0)	4,293(35.5)	4,911(39.6)	5,186(41.6)	5,299(41.8)	5,655(43.4)	5,917(43.7)
Universities	1,955(33.1)	2,338(30.5)	2,206(35.5)	2,190(37.9)	2,570(39.2)	2,733(40.8)	2,753(41.2)
Other Four Year Colleges	1,342(41.7)	1,425(40.3)	1,648(43.8)	1,633(44.8)	1,651(44.5)	1,658(45.8)	1,824(45.6)
Two Year Colleges	219(45.2)	314(51.6)	392(53.3)	412(55.8)	307(55.7)	410(52.9)	382(54.5)
Four Year Branches of Universities	269(35.3)	191(33.5)	644(35.2)	717(38.4)	749(38.5)	822(43.1)	924(42.6)
Two Year Branches of Universities	5(20.0)	16(31.3)	17(23.5)	25(44.0)	15(46.7)	32(37.5)	34(44.1)
Two Year Branches of Four Year Colleges	0 (0.0)	9(55.6)	4(50.0)	9(44.4)	7(57.1)	0 (0.0)	0 (0.0)